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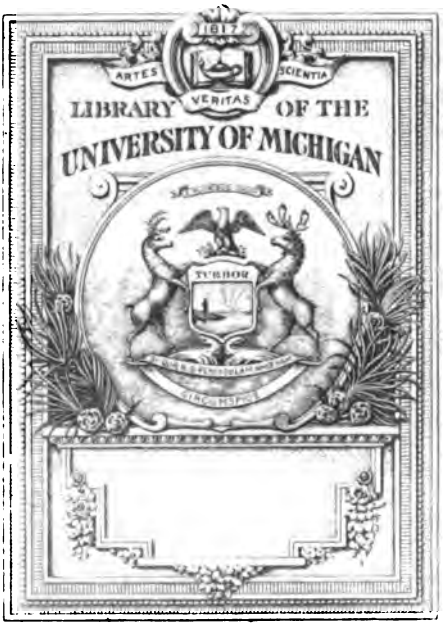
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ELIZA SHEPARD PUMPELLY WITH MARGARITA, 1874

MY REMINISCENCES

BY

RAPHAEL PUMPELLY

WITH ILLUSTRATIONS AND MAPS

IN TWO VOLUMES
VOL. II

NEW YORK
HENRY HOLT AND COMPANY
1918

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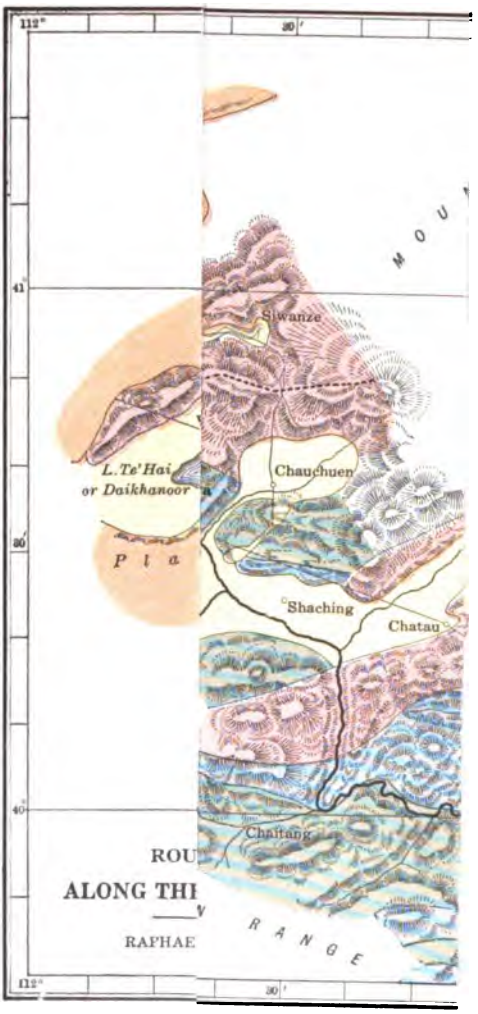
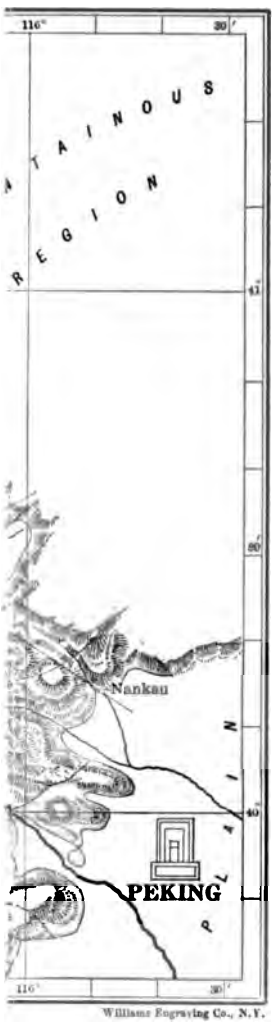


Loess Limestone

Carboniferous



Granite and
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CHAPTER XXXIII

ALONG THE GREAT WALL

I was fortunate in finding in Dr. Pogojeff, of the Russian legation, a companion for the journey. On the morning of the 5th of April we left the northwestern gate of the city. Nearly the whole of our first day's journey lay over the road by which I had begun my trip to the coal fields.

At Chang-ping-chau a road branches off to the tombs of the Ming Emperors, which I had visited on a previous excursion. These monuments of one of the most brilliant dynasties of China lie in a large circular valley, which, opening out from the great plain, is surrounded on all sides by limestone peaks and granite domes, a barren and waste amphitheater. Grand in its dimensions, and almost awful in its desolation, it is a fitting place for the Imperial dead of the last native dynasty.

Soon after entering the valley the road passes under an imposing gateway of sculptured marble, and after this beneath two large arched buildings. Some distance beyond these we came to the first of a long series of colossal forms of animals, in marble, standing on either side of the road. They form an avenue of half a mile or more in length. Of these there were on each side and facing each other: 1, two lions standing; 2, two lions sitting; 3, one camel standing; 4, one camel kneeling; 5, one elephant standing; 6, one elephant kneeling; 7, one griffin standing; 8, one griffin sitting; 9, two horses standing; 10, six warriors, courtiers, etc.

These pieces, thirty-six in number, are all colossal, and each is a monolith. In this remarkable avenue the figures face

each other, and in passing between them my wild Tartar horse reared and pitched with something of the terror felt by my mustang in passing through a more horrible avenue of standing mummified beasts on the Arizona desert.

From here the road leads directly across the valley, passing over several marble bridges, now more than half-buried under sand and gravel, and enters the grounds surrounding the central tomb.

At regular intervals, along a curve of a mile or more in length, upon the mountain side, are thirteen great halls, each consecrated to the memory of a Ming Emperor. Passing through the grounds of the central one we came to an imposing building, reached by a flight of long steps of which I remember only that its width is more than ninety feet, while its length is, I think, about two hundred. The ceiling, from forty-five to sixty feet high, is supported by a great number of pillars, distributed in several rows. Each of these columns is a single stick of teak timber eleven feet in circumference. These were brought from the south, and by a land journey of more than thirty miles from Peking.

Behind this memorial hall there rises an artificial tumulus, perhaps fifty or sixty feet high, through which there is built a rapidly rising and arched passage of white marble, leading to the summit, which is crowned by an imposing marble structure, a double arch, beneath which stands the Imperial tablet. This is a large slab, sculptured at the top with the dragon, and standing upright upon the back of a gigantic tortoise. Somewhere in this tumulus lie the remains of the Emperor, but the entrance to the tomb is nowhere marked.

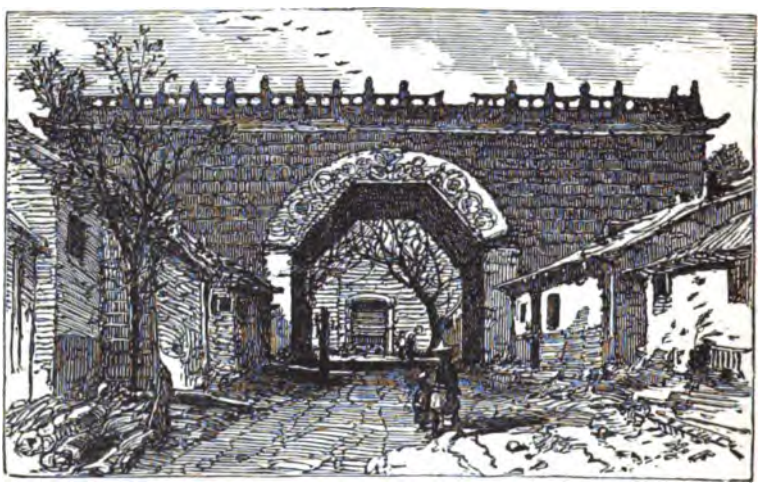
The twelve other Imperial sepulchers are said to resemble this one.

Long before we reached the mountains we could see the dark line of the defile which leads to the Nan-kau pass, and the watch-towers and fortresses and walls, winding from plain to

peak, which formed the innermost defenses of this important approach to the capital. In the evening we reached Nan-kau, our first resting-place, thirty miles from Peking. The next morning, leaving the plain, we entered the narrow valley winding for several miles through a desolate gorge, inclosed by high walls and yellow cliffs of limestone. The mountain torrent, which at certain seasons dashes wildly through the valley, makes the construction of a durable road almost impossible, and it was only with difficulty, and with faith in the sure feet of our horses, that we managed slowly to pick our way through the long and narrow field of sharp-edged boulders and masses of fallen rock. After several miles of this work we came to a point where what remained of an ancient road rising some distance above the bed of the valley was preserved along the mountain side. Ascending this by a long flight of steps, of highly polished blocks of stone, we passed through a gateway in an inner branch of the Great Wall, and soon after came to a beautiful white marble arch built during the Chin dynasty, third century A.D. This structure is remarkable from the fact that while its blocks are cut for a circular arch, the inner surfaces are hewn to produce a ceiling of semihexagonal form. It is interesting also to the student of the Chinese language, from the fact that the interior contains inscriptions in an ancient Chinese character. As Dr. Pogojeff wished to photograph this monument, we remained here till the next day, quartered upon a poor family who could offer us nothing but their good will and hot water for our tea. The next day, continuing the ascent of the valley, we left the limestone and came into the granite heart of the mountain. Here, at a point where a bold cliff overhangs the valley, there is a Buddhist shrine hewn into the face of the rock high above the path.

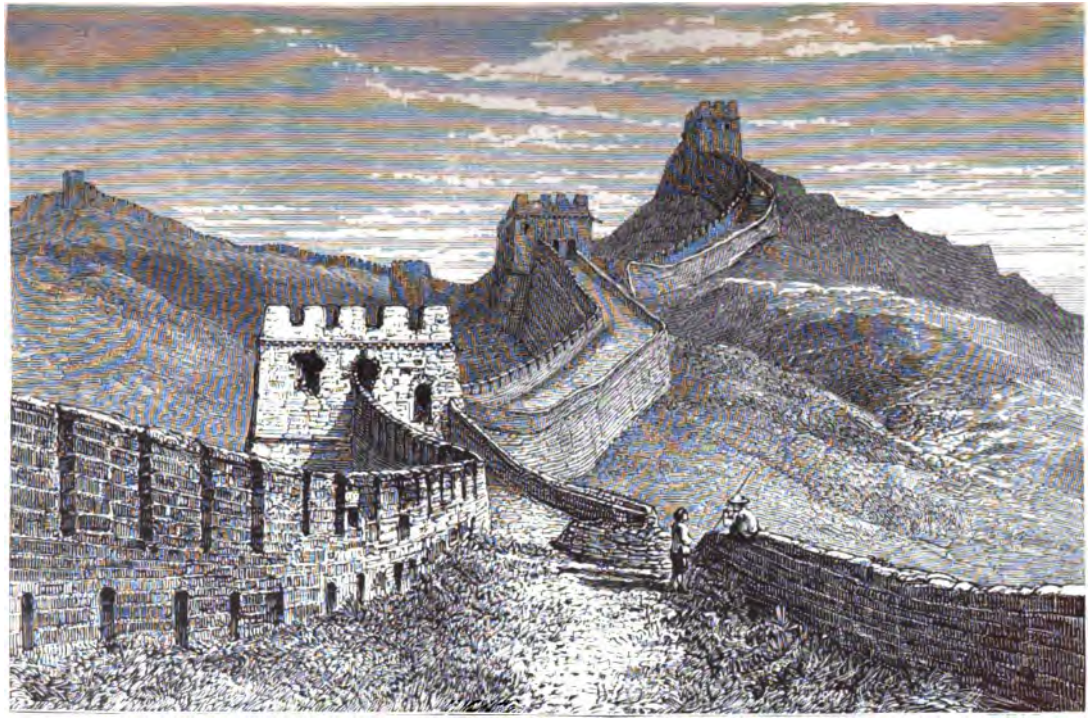
At many points in this mountain pass I observed the ruins of an ancient road, which, in its time, must have been built

with a great expenditure of labor and treasure. But the mountain torrent and the frosts of centuries have left but small traces even of the ruins. Here and there one sees a fragment of a massive arch, or in places a few rods of the old way paved with large hewn blocks of granite. All the greater monumental works in China, like the marble bridges and stone highways, date from times of governmental virility. Each incoming dynasty began with a vigorous administration. Highways were built or repaired to connect

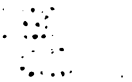


MARBLE ARCH IN THE NAN-KAU PASS

distant parts of the Empire, commerce flourished and the treasury was replenished. With the decline of each dynasty came the decay of public works, roads and bridges went to ruin, the Yellow River burst its dikes, famine decimated the population, and bands of robbers spread desolation. After traversing about two-thirds of the pass, the way leaves the valley. Here ascending by a difficult road through a desolate region of barren and shattered masses of granite, cleft to their base by gloomy chasms, we reached the summit and stood in full view of the inner branch of the Great Wall of China.



THE GREAT WALL OF CHINA



The importance of this position led to its being well defended. The wall is from twenty to thirty feet high, built here of hewn rock, parapeted, well paved on the top, and defended by towers at regular intervals of a few hundred feet. This structure, here almost as perfect as when it was raised two thousand years ago, winds along the mountain crest, climbing every peak, descending steep declivities, and supported at the edge of precipices on bold masses of masonry. Look where one will, its crenulated parapet and gray towers are visible in lines which apparently double and redouble on each other, now standing out against the sky on the peaks above us, or again winding along the lower spurs, and across the valley beneath our feet. Only the parapet is of brick. Wherever the wall ascends the mountain side, its top is built in steps to aid the ascent of soldiers. Many of the towers are several stories high, and are provided with loopholes and arched windows.

The descent to Cha-tau is extremely rough. This is an ancient fortress, commanding the northern approach to the pass, and is surrounded with ruins of massive towers and arched buildings.

Here we entered upon the first of a series of mountain plains, fringed with loess terraces.

This remarkable formation, called loess, covers northern China and the southern semiarid border of the Great Central Asian desert zone.

In northern China, with a thickness of often many hundred feet, this formation covers valleys and basins, and, rising with sweeping curves, mantles the neighboring mountains to a height of several thousand feet. Traffic on roadways, breaking the texture of the earth, prepares its removal by wind, and the road sinks slowly between high vertical walls. The whole thickness of the loess formation is a soil of extremely fine grain, and is charged from bottom to top with fertilizing

salts. The climate is too dry to leach these more than is needed to nourish vegetation.

Loess is the basis of the prosperity of northern China. Being a self-fertilizing soil, it is inexhaustible.

In the rest of China the yield of the soil is wholly proportionate to the amount of added fertilizer, and, as there this comes mainly from the human body, the amount of human nourishment and amount of population are mutually proportionate. When in southern China the population is reduced by rebellions, or by epidemics, its recovery is slow, and is dependent on the birth rate, there being little immigration. Cultivation is limited to the amount of fertilizer supplied by humanity.

In northern China, on the other hand, where the soil is self-fertilizing the yield is limited only by the extent of land each man can plant. Here the population is dense. When, however, there comes in northern China a drought, lasting several years, millions die in famine.

Picking our way over the stony plain, we reached the walled town of Yu-lin. It was already sunset, and we rode into the courtyard of the first inn we saw. I had hardly dismounted when I remembered that I had stayed one night at the same house on a former journey. At that time the landlord had brought to me his son, a boy about eight years old, begging that I would cure him. I could not make out what was the matter with him, and should not have known had I been told. In vain I insisted that I knew nothing of medicine. The landlord, believing all foreigners to be physicians and sorcerers, still urged that I should cure him. Finding all protestation useless, I had left some simple pills, with very wise instructions as to how they should be used. The incident had entirely passed from my mind, and now recurred for the first time when I found myself again in the same inn. "Heaven protect us!" I thought, "if the

child has by any chance died; for we shall have the whole town upon us in a mob." I thought the landlord looked very inhospitable as he showed us to our room at the head of the court. When he left I had begun to hope that he had not recognized his former guest. But before long the sound of many voices was heard, and the clattering of feet, which showed that the courtyard was filling.

Keeping my revolver near at hand I waited, not without some anxiety, for whatever might be coming. Soon the door flew open, and a crowd of men and women entered; but, much to my satisfaction, they were preceded by the very boy in question, led between his father and mother. The child and his relatives immediately went down on their knees, and, knocking the ground several times with their heads, expressed in warm terms their gratitude to the "honorable and wise physician" who had performed this wonderful cure.

Now we were besieged in earnest. The fame of the cure had gone far and wide, and it did not take long to spread through the pretty large circle of suffering inhabitants of Yu-lin, the news of the arrival of two doctors. During a good part of the night, and until we left the next morning, our room was a hospital for the blind and the halt, the deaf and dumb, consumptives and epileptics, and many other kinds of suffering humanity. The doctor could of course do little, and left with fees in the shape of well-earned blessings.

The Great Wall, with its countless towers, was visible several miles off, winding along the crest of the high mountains. Where the Yang-ho, leaving the plain, enters the deep gorge by which it finds its way through the rocky range, a large fortress like a walled city is built upon the mountain side.

Our road, after passing over several miles of fertile bottomland, approached the city of Hwei-lai, a place which in its day must have had considerable importance. A long and

handsome bridge of white marble with many spans here crosses a tributary of the Yang-ho; but several of the arches are gone, rendering it useless.

Beyond Hwei-lai the road, rising to the summit of a terrace, skirts the edge of the mountains, and passes through several walled towns, and near one or two which are entirely deserted, their crumbling walls inclosing now only cultivated fields. Further on there rose before us a high peak with ragged and precipitous sides, and crowned with ruins. This is called the Ki-ming-shan or Cock-crowing Mountain. A legend relates that two pious sisters vowed, the one to build a convent on the top of the mountain, the other to bridge the river below, between sunset and daylight. The sister on the summit fulfilled her vow, but the cock crowing before the other had finished the piers of her bridge, she drowned herself in despair in the river.

At Hiangshui we entered a kitchen house, and, sitting down at a rough deal table, ordered our dinner of the *Chang-kweitze*, or, as Abbé Huc calls him, "the inspector of the chest." There were stewed mutton, and fried mutton, and beef, and poultry, *chi-tang-chau'er* or fried eggs, *lau-ping* and *man-tau* or fried cakes, and steamed bread, and vermicelli. There was also pork in various shapes, but we knew too much about this. Excluding this, we ordered a little of everything else, and the cooking of our dinner began under our eyes. We heard the chickens squawk, and in a few minutes they were thrown through the window to the cook, who had them dressed and frying in a jiffy; the bread-maker put the lumps of *man-tau* into the steamer, and then busied himself with the *lau-ping*. Taking a large piece of well-kneaded dough, and making it into a stick a yard long, he drew, threw, pulled, and twisted it until it assumed the dimensions of a girl's skipping rope, and then doubling and twisting and pulling it again, producing a double stub and twist texture, he cut it into small

pieces, which after a good deal of flapping and patting became respectable disks. As he finished each of these he uttered a shout, and with a well-directed aim tossed it some thirty feet across the room to the cook. In the meantime another man was manufacturing vermicelli. Seated on a machine, some three or four feet above the cooking range, this man worked a long lever which moved a piston in a cylinder with a perforated bottom. At every stroke the long white strings descended into a boiling pot beneath, until the cook, judging that the quantity was equal to the demands of our appetite, cut off the material flush with the cylinder, giving the man on the lever time to curl up on the narrow board and smoke his pipe till another customer should need his services. While waiting for dinner, the traveler passes his time in drinking large quantities of tea, but during the meal the beverage consists of strong rice brandy, sometimes flavored with rose leaves, and always taken hot.

From this place the road, leaving the river, crosses a desolate region of low hills, and then descends into the plains, and after a few miles approaches Siuen-hwa (fu). This is a large city, once of considerable importance.

Our stopping place was outside the gate, but wishing to present a letter to the head of the Roman Catholic mission, we entered the city the next morning. Two broad avenues, intersecting each other at right angles in the center of the town, connect the four chief gates. At the crossing of these ways there stands a large tower several stories high and highly ornamented. It is pierced at the bottom by a groined arch, coinciding with the crossing of the avenues.

At the mission building we found only Chinamen, one of whom informed us, in very fair Latin, that the father had gone beyond the wall to administer the sacrament.

Kalgan (Chang-kia-kau) is one of the great market towns of the Empire, and a fortress of the Great Wall. The stream

here breaks through a short and narrow gorge with vertical sides, forming a natural outlet for the great highway to northern Asia. Here, too, is a gate of the Great Wall, and on either side of the gorge the time-worn structure and its towers are visible, climbing the steep slopes, and winding along the uneven mountain crest. The long pull to the top of the mountain is well repaid by the wide view. Climbing a ruined tower, I could see in the north the level outline of the table-land of Central Asia; while to the south, beyond the broad valley of the Yang-ho, the country rises in parallel ridges, the furthest and highest just visible as snow-capped domes.

The Great Wall was built about 200 years B.C., as a barrier against the hordes of Tartar cavalry. It was everywhere constructed of the materials found in the immediate neighborhood. On plains and terraces, which afforded clay and loam, it was constructed with an earthen core, built up in well-pounded layers, growing narrower toward the top, and faced with large tiles laid flat. The top also was paved with tiles, and defended with a parapet. On mountains of stratified rock the facing was made of masonry, and the interior filled with earth and cobble. Here on the mountain of Kalgan, where the rock is a porphyry, which breaks only into most irregular shapes, the wall is of solid masonry, the stones being laid in cement. Its section is here an isosceles triangle, the crest being brought nearly to a sharp edge. Everywhere throughout its length it is defended by towers, which rise from it at intervals of a few hundred feet. In many places the northern side was defended by ditches and embankments, but I do not know whether these formerly existed along its whole length, or whether the places in which I saw them were the sites of ancient attacks, during which these were made for immediate defense. Every mountain pass and every weak point was defended by a fortified town. The wall is now in very different states of preserva-

tion, according to the material used. In the valleys, the points where it was originally the most needed, it has crumbled into a mere line of rubbish, which is being rapidly graded down by the plow.

The home of the nomads, chiefly the *Hiung-nu* (an ancient Turkish stock), was on the plateau of Central Asia. Along the edge of this region the princes of Tsin, of Chow, and of Yau had built defensive walls during a time when China was subdivided into petty feudal states. When Tsin-chi Hwangti, "the first universal Emperor," had consolidated all these contending territories, he began the work of uniting all the northern defenses into a continuous whole. The result, after ten years of labor, was the Great Wall extending from the Gulf of Liau-tung, fifteen hundred miles west, to the mountains of Kan-suh.

Kalgan is the frontier town on the main highroad to northern Asia, and the point of union of two great channels of northern trade, coming from Han-kau on the Yangtz', and from Tien-tsin on the Pei-ho. This position made it the starting point of the caravans which carried the immense quantities of tea consumed by the eighty or one hundred millions of the inhabitants of Russia. It was also a distributing point for the more varied trade with Central Asia.

Before leaving Peking we had endeavored to obtain passports for Chinese Tartary; but the Government declined to assume any responsibility for our safety beyond the limits of the Great Wall. We now found that without such documents we could get no guides, either among the Tartars or the Chinese. This was, however, no great privation, as the prospect of being thrown upon our own resources, on a journey which had no definite point of view, added considerably to the romance of the adventure, which is the delight of the explorer. As no Tartars would accompany us, we were obliged to retain our Chinese muleteers. Besides these I had

my Chinese servant, and the doctor was accompanied by a Cossack from the Russian legation, who was both a Mongol by birth and a Buddhist in religion.

Leaving Kalgan by the gate of the Great Wall, we ascended a narrow gorge between cliffs of trachytic porphyry. Eight hundred or a thousand feet above us the precipice on our left was crowned by the black line and ruined towers of the wall.

After ascending several miles we were in Mongolia. Here also the Great Wall rises to the top of the plateau. From a crumbling tower, standing on the very edge of the escarpment of the table-land, I obtained one of the fine views which, among the many reminiscences of extensive journeys, stand preëminently impressed upon my memory. Stretching far away on either side there was the precipitous edge of the plateau, overhanging the lower country as the cliffs of a bold coast overhang the sea. To the north lay the boundless steppes of Tartary; to the south the mountains of China. We were here on one of the sharpest boundary lines drawn by Nature on our planet. The change is extremely abrupt geologically and topographically, from the broken and barren mountains of metamorphic rocks, Devonian limestone, and Triassic coal measures to the high grass-clad plains forming the surface of the comparatively recent volcanic rocks and marine deposits of Mongolia and stretching northward to Siberia. Climatically and socially the transition is not less sudden; the plains to the north receive winds which have been drained of their moisture by the broad belts of surrounding countries. Being thus scantily watered, and possessing no fuel but the dung of cattle, they are suited only to the subsistence of pastoral nomads, and their herds of sheep, camels, horses, and cows. The habits and status of these wanderers are fixed by Nature; there can be no progress, no transition from the nomad life to a higher order of existence, since the

very elements of such progress are excluded by the surrounding physical conditions. Nowhere is the influence of Nature over the condition of man more marked than here. There is no apparent limit to the length of time that a nomad race might roam over these plains without advancing a step in the social or intellectual scale; but simple habits, life in the saddle, and a meat diet have made of them a race of hardy warriors, needing, when they were more numerous in the past, only a Gengis Khan or a Timour to make them shake the world.

South of this boundary all is different. When the early Chinese first entered China they entered also upon a new life.

If the Chinese came from the Taryrn basin in Central Asia, as their historians think they did in the twenty-third century B.C., they came as agriculturists indeed, but from oases along the great desert into a region of great river systems, forests, and mineral wealth. These varied gifts of Nature, and the temptation to use them; the obstacles also offered by Nature and man—and the necessity of overcoming them—these were the seeds which were to ripen; and being planted in a land wonderfully adapted to their growth, out of them has arisen, step by step, a great and unique civilization.

From one ruined tower we could see the winding courses of the Great Wall. Though not always sufficient, it has withstood more than one shock. Tempted by the wealth of the Empire, in wave after wave the fierce hordes of the North have spent their fury and their strength against this wall, and, rolling back, have overwhelmed the less resisting nations, even of Europe.

I could see that the general course of the plateau escarpment was as sinuous as a coast line, bending northward in deep bays, or jutting south in long peninsulas, terminating in bold promontories. The belt, from ten to thirty miles wide, lying between its base and the mountains of northern Chi-li,

is far below the level of the plateau. The plateau at its edge consists of a black volcanic rock. This, with the loess-dust, furnishes the soil and nutriment for the heavy growth of grass with which the plains are covered.

The elevation here above the sea is 5,400 feet, and is probably not less than from 3,000 to 3,500 above Kalgan. From this southern edge the general elevation of the plateau drops off to the northward to the sand desert of Gobi.

Near the tower which has just been mentioned is a small postal station called Hanoor. The view inspired me with a wish to travel westward on the table-land, keeping near its edge. This plan seemed to promise both insight into the geological structure of the country, and a greater variety of scenery. I knew that Hanoor was near a caravan route which, branching off from the post road, took a westerly course; but the only information we could get from the people was that the first place to the westward was called Borotsedji. As it was already afternoon, we determined to make that point our stopping place for the night. Leaving Hanoor with the intention of following the first indications of a route to the west, we passed a small lake with no outlet, covered with ice, excepting around the edges. In the little open water thus left them were many ducks, pioneers of the annual migration northward.

Seeing some antelopes in the distance, I left the road, with the doctor and the Cossack, to get a shot. The unaccustomed excitement put us so far off our guard that, when we had finished the fruitless chase, we found ourselves lost. After trying for some time to find the route we had left, we struck out in a northwestwardly course, determining to keep this till we should find some brook, by following which we should probably come upon a Mongol encampment. After ascending many knobs we came upon the top of a hill, from which the Cossack pointed to some objects on another summit, which he

said were sheep. On reaching the hill we found to our great surprise that there were no animals, and that we had been misled by an optical illusion; a few small stones, not a quarter as large as a sheep, had been distorted by an atmospheric effect. The sun was already sinking near the horizon when we reached the top of the next hill, and here an unexpected sight met us. The rays of the setting sun were brilliantly reflected from the gilded vanes and balls which decorated the roof of a temple about a quarter of a mile distant. It lay in a broad, grassy valley, the slopes of which were so regular and gentle that it was impossible to tell where the meadow ended and hillside began. A narrow, shining brook meandered through the meadow, and toward this thousands of sheep and camels, horses and cows, were wandering over the plain.

Around the temple there were a few houses of brick, and a small village of tents. It was nearly dark before we reached the place, but we could distinguish the outlines of a large inclosure surrounding some buildings, and the loud barking of dogs served as a guide. Fighting our way into the court through an army of savage curs, we found our pack-train already there, and that we were in Borotsedji. This was a large establishment for the collecting of wool and hides. The nights were still cold, and the *kangs* or beds were heated. I believe I have not yet given a description of these peculiar Chinese couches. At the end of the room there is a raised platform, about two feet high and eight or ten feet wide, with a length equal to the breadth of the room. The whole is constructed of bricks, and has underneath it a large fireplace, with horizontal flues extending everywhere immediately under the surface. The top is covered with a coarse, hard matting of split bamboo, and forms the bed of as many people as can be uncomfortably packed upon it. Every traveler carries his own bedding, unless he wishes to sleep without

any. Now, the *kang* at Borotsedji, although unusually large, presented not much more area than was needed by the Mongols and Chinamen, and when we added our party of six we were packed rather more closely than was comfortable. The top of the *kang* seemed comfortably warm, and as we made up our beds the head of the house added to the fire a liberal supply of dry dung. During the night the heat which collected under the blankets was unbearable. I awoke to find myself being really stewed. My clothes were drenched with perspiration, while a powerful effluvia steamed off from some ten or fifteen bed-fellows, to whom bathing was unknown. Not less suggestive was the incessant scratching, by which my neighbors kept up a constant fight in their sleep with the denizens of their sheepskin clothing.

This part of the table-land, from the southern escarpment northward, consists of an immense development of beds of volcanic rock, which form a belt of irregular width, of at least a hundred and fifty miles in length, and defines the southern edge of the plateau.

Our way westward took us through a series of meadows, connected by the smallest possible brook till we came upon the banks of a little lake covered with thousands of ducks. There was, however, no cover, and before we could get within range the whole flock had taken flight.

Beyond this the country dropped off rapidly to the west, and we found ourselves, almost before we were aware, at the entrance of a narrow and winding defile. Two or three miles of descent brought us suddenly out upon a terrace, beneath which there was spread out a broad valley, with fields and villages. We had unawares left Mongolia and had reëntered China. The whole aspect of the country below us was different from that we had left. Behind us was an unbroken mantle of green, while the region before us was a mass of yellow loess, which was carried by the wind in columns and

clouds across the surface. The prospect was certainly uninviting. We had started for a journey among the Tartars of the table-land, and here, almost at the outset, our course had brought us into the valleys of China.

Continuing the descent, we came through dusty roads to Tau-li-chuen, where we passed the night. Here occurred the only instance of dishonesty that happened to me in China. While the animals were being packed in the morning we had all left the inn for a few minutes, and on returning had missed a bag containing all the silver we had brought for the journey. This was too serious a loss to pass unnoticed, and we began a search into every nook and corner of the inn. Not a box or barrel escaped, no room or chest, even the women's quarters were not too sacred. The fear of having an end put to our journey overcame scruples of modesty, and amid torrents of abuse, such as only a Chinese woman is mistress of, we turned men and women out of bed to examine mattresses. Finally the missing treasure was found, hidden behind some barrels. Nothing but the rapidity with which we had conducted the search, and the fact that the stolen property was really found in the inn, prevented us from being mobbed by the crowd which the landlord had collected.

My experience in China, especially in the north, did not corroborate the accepted ideas concerning the dishonesty of the Chinese. In this connection I might as well relate an incident which happened in Peking. Walking one day on the banks of one of the large ponds of goldfish, which cover many acres in the city, I called a ragged boy, the only person in sight, and giving him a Chinese banknote, of the value of about two dollars and a half, told him to buy two cents worth of bread for me to throw to the fishes, and to bring back the change. The nearest houses were an eighth of a mile distant, and as the boy made his way toward these my companion, who had long been a resident in China, laughingly assured me

that I had seen the last of the money. Not unwilling to back my faith in the boy's honesty, I accepted a wager and awaited the result. The boy evidently belonged to a lower class, and knew that we could not recognize him among thousands like him in the city. Moreover, the amount was to him what many dollars would be to one of the same class in New York or London; and yet he returned with his hands full of bread, and bringing the change.

I must add that in all of my visits to hundreds of shops in central and northern China, it never happened to me that the dealer tried to deceive me as to the quality of any article; quite to the contrary, he always took pains to point out even the smallest defect which might have escaped my examination.

It is true that the seller always asked more than he expected to get; bargaining over prices was the universal rule of trade, and was a privilege seemingly highly cherished on both sides.

CHAPTER XXXIV

ALONG THE GREAT WALL (*Continued*)

We rode northwest across the fields toward the distant escarpment of the plateau. The farmers were planting, and plows and harrows of primitive forms were at work in the fields. Among other implements I noticed a machine something in the shape of a wheelbarrow, to which was attached a hopper, and which was intended for sowing grain in drills. Over the surface of one of the fields which we crossed were scattered small heaps of material that proved to be a mixture of manure and earth containing beans. By planting portions of this in holes, a great economy of manure was effected.

When we returned to the table-land we again saw how sharp is the boundary which the escarpment draws between the two races. The yellow loess fields of the Chinese come to the very foot of the precipice, while at the top the grassy plains furnish pasture for the flocks of the Mongols to the very edge. The Chinese in the valley were ignorant of the Mongol names of places on the plateau, while the nearest Tartars seemed to know as little of Tau-li-chuen. Upon the plateau we frequently came into the broad tracks of caravan routes, but being ignorant of their destination we generally avoided them, laying out a course of our own.

Supposing that we should now have little trouble in remaining upon the plateau, we followed the general westerly direction of our journey. For a few miles our route lay over the level plains. The decomposing volcanic rock here furnishes sustenance to an exceedingly rich growth of grass,

which in the early summer reaches the height of several feet. Before noon it was clear that the country to the west of us was rapidly descending, and we soon came to the brow of a declivity from which we saw spread out beneath us a broad, rolling region dotted with Chinese villages, and cultivated to the foot of the descent upon which we stood.

Here again the view was obscured by the clouds of dust which in the cultivated portions of northern China, before the crops have reached a height sufficient to protect the surface, are constantly raised by the prevailing westerly winds. The country which we had passed through during the morning was apparently used neither by Chinese nor Mongols. To the former, like every other part of the plateau, it was forbidden ground, and to the Mongolian herdsmen the close proximity to the Chinese dogs rendered it here probably rather dangerous grazing country.

The escarpment of the plateau, several hundred feet above the cultivated country, stretched far away to the north. Much as I wished to remain upon the plains of Tartary, I did not dare risk the delays which might shorten our journey westward by making a detour of indefinite length to the northward.

Regretfully casting, for aught we knew, a last look at the grassy plains, we descended once more to the dusty fields of China.

At a small settlement, the first place we had seen without an inn, we had much difficulty in finding quarters for the night.

After applying in vain at several places we came to the most respectable-looking farmhouse, where we were also refused admission. There being no other way, we determined to take possession. The farmhouse was surrounded by a large inclosure, with a gatehouse having several rooms, and in one of these we established ourselves. Then came the

efforts to dislodge us. First appeared the master of the house, who politely informed us that he had nothing for our horses, that the room was occupied by others, and that his family was on the verge of starvation. His well-rounded person and smooth face added no force to this protest. Then came, successively, a number of men, who all protested and entreated, and finally departed with threats to rouse the population of the village against us.

Things began to look serious; but the worst was to come. The shrill tones of a troop of women were heard crossing the court. Headed by the lady of the house, they burst into the room and filled it not only with their persons but with invectives. My experience on the Yangtz' River had taught me that the hardest attack to resist would be a troop of Chinese women. As our best and only ally in the fight with the soldiers at Chang-sha had been the wife of our skipper—the woman who had turned the day in our favor—I now concluded that, as we could not fight women, we should have to give up our quarters unless we could make the women fight for us.

"Leave this house!" they said. "You are impertinent, red-haired foreign devils!" "You turtles' eggs!" "You cross between a drake and a toad!" "What right have you to come into people's houses when you are not wanted?"

It was certainly not easy to answer invocations made with so much earnestness. Opening our bag of silver, I rolled out the large, rough lumps of the metal, and, displaying them, said through our Chinaman to her who seemed to be the mistress:

"Madam, we wish to take nothing by force. We want little, will pay liberally for what we get, and leave in the morning."

The sight of the money had a soothing effect, and removed us from the suspicion of being lawless characters. The old

woman then in a softer tone informed us that the room we were in belonged to her son, who was an "unfortunate."

"What is the matter with him?" I asked.

The answer was given by a bystander, who informed us that the young man was an idiot, who spent all his time in wandering about the country gathering pieces of stones. I carefully shoved the geological specimens which I had collected that day under a blanket.

Pointing to the doctor I said to the mother: "My good woman, this gentleman is a physician, and may be able to help your son."

The effect was immediate. The old woman bounded from the house, and soon returned, followed by a young man, a hopeless idiot.

The doctor told the mother that it was a case beyond his power, and that he could do nothing. He patted the "unfortunate" gently on the forehead, and from that moment the poor fellow insisted upon staying near his new acquaintance, every minute motioning to the doctor to put his hand again upon his head. This gentle treatment won the heart of the mother, and through her of every one in the house. Our horses were stabled, and a bountiful supper soon appeared.

The next morning we found ourselves besieged by all the suffering population of the surrounding country. The quiet farmhouse seemed suddenly transformed into a temporary dispensary for every form of disease. The patients were accompanied by friends, and in the tenderness and sympathy shown by these I read a phase of the Chinese character for which foreigners have never given credit to this phlegmatic race. The doctor did what he could by confining himself chiefly to diseases of the eye, for which he had brought remedies.

The people of the house showed their gratitude by steadily refusing pay, while others overtook us on our way bringing

offerings in the form of oats or hay, which they forced us to accept.

Following a narrow trail running westward we rose to the surface of the plateau, and immediately descended to a series of circular plains, which were formerly lakes, but which were now rich meadows connected by a winding brook.

Riding along the little stream, we came before sunset upon Mongols driving herds of sheep and cows, and further on to the encampment of Hoyurtolo-gol.

Dismounting at the best-looking *yurt* and leaving my whip outside, in accordance with the custom of the country, I entered the dwelling, in which were a middle-aged woman and a girl of about seventeen. To the former I gave immediately an empty bottle, and to the latter a red scarf, and our good reception was assured. The old woman was very good-natured, and the daughter was the most graceful, and I might say the most beautiful, woman I had seen since leaving Japan. This girl showed a modest ease and grace in exercising the duties of hospitality which astonished me, as she had probably never before seen a foreigner.

These Mongol *yurts* are circular, generally about fourteen feet in diameter, with a collapsible and portable trellis-frame wall about four feet high. From the top of this frame springs the roof, in the form of a dome. The whole is covered with thick felt, leaving a circular opening at the top, through which the smoke escapes. The entrance is a small square opening, protected by a heavy curtain; and the only furniture is generally a chest, with a small Buddhist shrine, and a ritual in Thibetan if one of the sons be a Lama. The ground is covered with felt mats, and the bedding, generally of sheepskins, is stowed away around the circumference. In the center of the dwelling a small tripod supports the cauldron, which is the only cooking utensil.

From the framework of the tent hang pieces of dried meat,

and the few other articles of food. Perhaps it was the good looks of our young hostess which inspired us with confidence in the cleanliness of the place; but in this we were sadly deceived, for on leaving the next morning we felt that we had carried away with us some of the superabundant inhabitants which infest alike the dwellings of Mongols and of the poorer Chinese.

It was now only the 17th of April and yet the whole country was clothed in the full beauty of spring, while from higher points we could see far away to the south the mountains of Shan-si covered with snow. Around us the flat-topped hills, their sides and the broad meadows between them forming an unbroken carpet of green, were mottled with the flowers of early spring.

Scattered over the country herds of cows and sheep, horses and camels were lazily grazing, while the Mongolian herdsmen, too heavily dressed in skins to walk, lounged listlessly in their saddles, or spurred their horses across the plain to meet and wonder at our cavalcade. The valley led us through a narrow defile road soon to cross a lava stream one or two thousand feet broad, and from sixty to eighty feet thick. This rock has a beautiful columnar structure, and appears to have flowed down from a neighboring mountain, which has all the appearance of a half-destroyed crater.

The eruption must have been subsequent to the erosion of this part of the plateau. It was the only instance in which I observed traces of true volcanic action, more recent than that to which the volcanic formation of southern Mongolia owes its origin. Near this point there was a large Chinese cattle ranch, at which we nooned.

After a long ride through a rocky country we came, toward sunset and in the midst of a drenching thunderstorm, to the Mongol encampment at Chaganoussu. Applying for admis-

sion at the principal tent, we were peremptorily refused by the old wife of the chief.

We learned that the men of the place were mostly away on military duty, and that the women were frightened at the arrival of our strange party. The doctor and I entered the tent with the hope of conciliating the chieftainess by means of presents, but it was useless. She stormed, and insisted upon our leaving, and went so far as to strike the doctor in the face.

This act so exasperated my Russian friend that he involuntarily drew his revolver, at which the old woman gave a howl and bounded out of the tent. Fearing that there would be trouble, we formed our party in the open space among the *yurts*. We had not long to wait. In a few minutes the woman reappeared, leading a motley crowd of Chinese and Mongols, armed with sickles and clubs, whom she inspirited with wild gesticulations and loud cries. There was something half-ludicrous and half-serious in the appearance of this novel force, as it rushed downhill toward us, headed by the enraged woman, whose robes and disheveled hair were streaming in the wind; and the effect was heightened by the loud peals of thunder, and bright flashes of lightning, which broke at once the silence and the coming darkness of night. The enemy came on and surrounded us bravely enough, until they perceived that, instead of being frightened and fleeing, we quietly stood our ground and only laughed at them, and that moreover we wore revolvers in our belts.

Being somewhat cooled in their ardor, they formed a large circle around us, evidently needing stronger inspiration before beginning an attack. The old woman danced with rage, calling us and her followers all sorts of bad names, but all to no purpose. We continued to walk quietly up and down, smoking our pipes, and the attacking force maintained its distance. This state of things might have lasted all night

had not the arrival of a Lama, who was the son of the woman, brought us an ally. Understanding Chinese, he soon learned the position of affairs, and pacified his mother sufficiently to gain for us the right of using the tent. The volunteers were disbanded, and the only bad result of the battle was a thorough drenching all round.

A Mongol village, Hoyurbaishin, consisting of houses built in the Chinese manner, was the first of the kind we had seen among this people. In return for the hospitable reception we received here, the doctor photographed the inhabitants. The most patient as well as the most delighted sitter was the wife of our host, who made up for her lack of beauty by the gay color of her silk dress, and by the amount of silver ornaments braided into her hair.

Soon after this we looked down upon the Lake Kir-nor. Seen from the plain, the face of the inclosing plateau escarpment is everywhere marked by parallel horizontal lines, which are continuous on the same level around the headlands and valleys of the wall, and are reproduced on the sides of a hill which rises from the plain. They are visible through a field-glass at a distance of ten or twelve miles, defined where the ascent is gentle by masses of large and small fragments of rock, and on the steeper declivities by a slight variation in the angle of slope. They seem to mark former levels of the lake surface.

The only trees which we saw after leaving Kalgan were two about twenty feet high growing in the rocks at the foot of the plateau wall.

After a gradual ascent of one or two hours we came again among the flat-topped hills and shallow valleys of the plateau, through which we wound for several miles. Quite unexpectedly we came upon the brow of a precipice, overlooking a broad circular valley several hundred feet beneath us, presenting an unbroken surface of grass, covered with thousands

of grazing animals. In the distance the gilded vanes and balls of a Lama temple reflected the rays of the setting sun, and gave the place the appearance of an enchanted valley. The sun had set before we found a practicable route for descent through a narrow gorge.

It was night when we reached the Lamasery. This is one of the many temples and small monasteries which are scattered through the valleys of Mongolia, subordinate to the few larger ones which are the seats of greater Lamas. They form the centers of pilgrimage for the immediate neighborhood, and are the schools in which the young Lamas get the elements of their religious education. They are well patronized, as it is the custom for almost every family to set apart in early childhood one of its sons for the priesthood.

This was the last of the Mongol settlements, for the next morning we found ourselves among cultivated fields, and soon came into a Chinese village. The fame of the doctor had already reached this place, and while we were at dinner the court of the inn was filled with people wishing to be cured by the magician from over the sea. Evidently there was no lack of faith to help the action of medicine. They were chiefly troubled by diseases of the eye, and we were surprised to see how bravely old and young bore the application of caustic agents.

We had gone but a short distance when we were overtaken by several of the patients bringing bags of oats, which they pressed upon the doctor.

During the afternoon we suddenly found ourselves again upon an escarpment of the plateau, and overlooking a broad plain sunk a thousand feet or more beneath us, surrounding the salt lake *Dai-Kha-Noor* or *Te-hai* Lake, covering several square miles.

Perched upon the highest points of the plateau, there are ancient and crumbling watch-towers. They are silent monu-

ments of a time when the shores of these lakes formed the base of an aggressive race, ever threatening a descent into the fertile regions of China.

In the southwest the valley is open, or perhaps divided only by a low watershed from the plains of the Yellow River.

It was here that we first heard of the Mohammedan rebellion, which, after spreading through Kashgar and Yarkand, and through the western and northwestern provinces of China, had now approached to within two days journey of the Te-Hai. This state of things rendered it useless for me to think of carrying out my journey to the Tien-shan, and I decided to return immediately to Peking.

We left the plain of the Te-Hai through a deep gorge, across which runs a great "fault" line on whose southern side the plateau has been sunk perhaps 600 or 700 feet and leaving the lower plateau 300 feet or more still above the valley.

Toward evening the gray walls of the large town of Fung-ching appeared above the plain, reminding us that we had reëntered China. In the midst of a drenching rain we passed the ruined gate, and traversed in darkness the narrow and muddy streets of the city. In vain we applied at inn after inn; none would receive us. In spite of the storm a large rabble of men and boys collected around us, growing more and more insolent after every failure on our part to find a resting-place. Tired and exasperated, we determined to proceed to the *ya-mun* and demand assistance from the magistrate. After being several times misled, through the malice of pretended guides, we arrived at the court of justice, followed by an unwelcome retinue of a thousand or more vagabonds. Theoretically every magistrate in the Empire, and even the Emperor himself, is obliged to give immediate audience to any one who may sound the great gong before the *ya-mun* or the palace, but at the present day few China-

men would be foolish enough to expect an answer to such a summons.

Knowing that any intimation to the magistrate of the presence of foreigners would be placing him on a bed of thorns till he knew that we were housed and beyond the possibility of involuntarily creating a mob, which might cause him the loss of his place, we proceeded to take the most effectual means of making him aware of our presence. Riding up to the great gong I seized the beater, and with vigorous strokes sent reverberating through the night air, through court and hall, such echoing of barbaric tones as should rouse his worship, even though he were deep in the sleep of opium. Immediately the great gate swung open, and the wire-capped executioners and retainers of the *ya-mun* hurried out to learn who was so daring as to intrude so summarily into the precincts of justice.

I demanded instant audience of the magistrate, and in a few minutes a secretary appeared, saying that his master was too ill to be seen. Giving him our passports and telling him of our trouble, I demanded quarters for the night. This produced the desired result. The magistrate despatched several bailiffs, who led the way to one of the inns at which we had been refused admission, and this time we had no trouble in obtaining the best rooms in the place.

I found that the dislike of foreigners had originated in the bad conduct of two who had preceded us.

The highly cultivated valley at Fung-ching is cut up by rows of willow trees, raised for charcoal; and the water of the creek is carried along canals to turn the wheels of mills. After descending the stream for a few miles we rose to the surface of the lower plateau, and came again under the shadow of the Great Wall.

After a ride of a few miles we descended from the lower plateau and bade farewell to the table-lands of Central Asia.

In a quiet village of farmers we found comfortable quarters among people who were eager to show hospitality. Everywhere in China I found the country people civil and kindly disposed, contrasting strongly in this respect with the rabble in cities.

The plain of Kwan-tung-pu is occupied by a heavy deposit of loess. In broad valleys where this material is 100 or 200 feet or more deep, it makes a remarkable and peculiar landscape. Here a tributary of the San-kang-ho has cut out its course to the depth of one hundred feet or more. From the valley thus formed, narrow and equally deep ravines extend on either side, the result of retrograding erosion. One of these chasms, more than seventy-five feet deep, with a width of only six feet, between vertical walls of loam, was seen winding in a crooked course for more than a mile up the slope of the plain.

An ancient fortress commands the entrance to one of the gates of the Great Wall. Passing the gate we entered a deep gorge, by which the mountain range is here cleft to its base, and through which we traveled seven miles.

Leaving this gorge we entered the valley of the Yang-ho, and soon reached the walled town of Yang-kau.

Leaving the valley and ascending to the surface of a wide plain of loess, we slept at the village of Ta-kiau.

On the following day we found this plain like the one of Kwan-tung-pu, cut up in every direction by deep and narrow ravines with vertical walls of loess. Some of these, of very recent origin, had extended across the roads, compelling us to make considerable detours.

In places the wagon road, deepened by the winds, is sunk from fifty to a hundred feet below the surface of the country, between vertical walls which barely leave room for one cart.

The rest of the route to Kalgan, although geologically interesting, was devoid of general interest.

A Roadway Hollowed in Loess by Wind and Traffic

From Richthofen's *China*

From Kalgan we went to visit the Roman Catholic mission of Si-wan, a day's journey to the east, where we received a hospitable welcome from the kind-hearted missionary, who seemed well pleased to meet travelers of his own race. Containing almost solely a population of Chinese Christians, Si-wan was one of the many monuments of the zeal of the Catholic missionaries, who were scattered not only through China but in every part of the pagan world. As it was situated some distance from the seat of the magistrate, this small colony attracted but little attention and persecution. Their internal troubles were adjusted by the priest, whose influence rarely clashed with that of the civil authorities, and was then, I believe, generally exerted for good. Few new converts were in my time made in any part of China, the native Christians being generally, like the few thousand souls around this mission, the descendants of the proselytes of the seventeenth century.

The mission is neatly built, and the church tastefully decorated. Most of the dwellings of the people were excavated in the loess deposit, each house having several rooms, divided by walls of loess left standing, and finished with cement. They were neat and comfortable, and had the merit of being warm in winter and cool in summer.

At Si-wan I found a man whose name figures in one of the favorite books of my boyhood, and whom I had certainly never expected to see. This was no less a person than Samdad Chiemba, the Lama cameleer of Abbé Huc, and the companion of that intrepid missionary in his long and dangerous journey through Tartary and Thibet. He was no longer the wayward boy over whose caprices the readers of Huc's charming narrative have often laughed. I engaged him as a guide over the rough mountains to the south. To avoid the long detour by way of Kalgan, we struck due south, over the high mountains between Si-wan and the Yang-ho. On one of these ranges

we crossed again the Great Wall, here defended on the north side by three parallel ditches which may be the remains of local earthworks thrown up during some ancient engagement. Descending into the valley of Chau-chuen we passed several villages excavated in the face of loess terraces, and on the following day reached the Yang-ho at Ki-ming; and thence, following the route by which we had come, after an absence of six weeks, we reëntered Peking.

The time had come for me to leave Peking permanently. Mr. Burlingame and Sir Frederick Bruce suggested that I might well remain in China and enter the Customs Service. I might probably have a salary of $12,000. In one sense the suggestion was tempting. The Customs Service had been established under the direction of able Englishmen, and Robert Hart was then its head. The members were all carefully selected men, largely from the English universities. However, I preferred to live my life and career in my own land.

CHAPTER XXXV

FROM PEKING TO NAGASAKI

It was now the middle of May, and the season was already advancing beyond the period of comfortable traveling through the Indian Ocean and Egypt. This was the route I had chosen, after failing to find a companion for a journey through Siberia. Taking leave of my many kind friends at Peking, I set out on horseback for Tung-chau on the Pei-ho. The distance is only about twelve miles over the granite causeway that connects this port with the capital; but I lengthened the time of the ride by lingering at the bridge of Pa-li-kiao, the site of one of the last battles in 1860, where the Tartar cavalry, with miserable weapons, made a most desperate resistance against the allied forces.

At Tung-chau I found my baggage already on board the boat, which had been engaged by my temporary companion, a young missionary.

It may not be uninteresting to the reader to have a slight sketch of this person, whom, though in no unfriendly spirit, I must call a religious adventurer. While yet a boy, feeling himself called upon to become a missionary, he started without any credentials and without having been ordained. Enlisting as a marine, he went with the United States squadron to Japan, and there leaving the service, began studying the language. Having no means of support, he opened a tailor shop, and managed to eke out a subsistence, although, as I know by sad experience, he was apt to make one leg of a pair of trousers shorter than the other.

Failing in his attempt to convert the Japanese, he became

a merchant and failed again, owing a large amount, in an attempt to overstock the China market with lumber. Determined again to become a missionary, in a new field, he went to Shanghai, and failing there to get a passport for the interior, proceeded to Peking.

During this time he had learned a little Chinese, and had determined to spread the gospel in the most inaccessible provinces of the West. He had obtained his passport, and was now on his way to Tien-tsin, the starting point of his journey. He complained bitterly that he had been snubbed by all the missionaries at Peking, who had even refused to allow him to pray in their evening meetings. On our boat journey, whether asleep or awake, he talked constantly, and always in Scriptural quotations, denouncing the missionaries as "sons of Belial," or complaining of his money losses, or yet calling down vengeance upon the Chinese if they should hesitate to receive his "glad tidings joyfully."

A monomaniac, he was about to undertake entirely alone one of the most difficult journeys on the globe, and was going undisguised through regions where, at the time, even the Catholic missionaries could hardly penetrate when disguised and always surrounded by their converts. I left him at Tien-tsin, after giving him my camp outfit, confidently expecting that he would never again be heard from.

"I am going to spread the Word of God in every department of every province of China," he said.

Several years later he came to see me in America. When I showed surprise at his having come safely through his proposed journey, he exclaimed:

"I have done the work. I have been beaten and bruised and cut; I have been left for dead; but I have left the Word of God in nearly every department of almost every province in that heathen land. And now if they don't accept it, there isn't any reason why they shouldn't be eternally damned!"

His method of spreading the "Word" was to leave a leaf of the Bible in each place!

His career was remarkable. Starting with a cartload of Bibles, he traveled across Chi-li and Shan-si to the Yellow River. Here, coming upon the line of engagement between the Imperialist troops and the Mohammedan rebels, he was arrested by the former, and sent in a boat down the river to the seacoast. Not daunted by this rebuff, he started from Canton with another load of Bibles, and traveling through the southern provinces of China penetrated into the almost inaccessible region of Yun-nan, where he barely escaped death in several attacks of banditti.

The last time that I heard of him, he was circulating petitions through the United States for the pardon of Jefferson Davis.

In leaving China I should add for what they may be worth a brief summary of my impressions of the Chinese character.

In the light of my experiences in China, the people, their way of thinking, their ethical and religious aspirations appear unfathomable by the Western mind. The foreigner bases his generalizations upon few or many observations, and in interpreting these he is apt to be influenced by the theoretical, social, and religious standards of Western civilization, or too often by the prejudices prevailing in the foreign communities.

The ethical standard is fundamentally based on the Golden Rule, slightly differently phrased, *"Do not unto others that which you would not that others do unto you."* But in practice here the observance of this precept is more limited than with us. But during the millenniums that have passed since the time when Confucius and Hu-chi and Lautze taught ethics in a land of plenty, Nature and evolution have slowly and relentlessly changed the relation of the people to their environment—a change from abundant provision for a small population to an unstable equilibrium for a dense mass of

humanity. For a long time the productivity of the carefully cultivated soil has under normal conditions barely balanced with the population.

Repeated bursting of the dikes that control the Yellow River have flooded the vast fertile plain of northeastern China; years of drought have desolated the rich loess lands of the North, in each case killing millions of people and driving the survivors into beggary and brigandage. Life has long been a struggle for existence—a fight in which altruism found a limited field for action beyond the family circle where it reigned supreme.

In this struggle only the fittest could survive and they were those who were physically strong, thrifty, capable of prolonged work and prompt in fulfiling their obligations to others; for, absence of these requirements meant disgrace not alone to the individual but, which is worse, to his ancestors.

Thus in a favorable environment evolution has built up a native civilization in which the most distinguishing traits are universal ability to work with a minimum of fatigue, widespread commercial genius and a marked sense of commercial honor; and, in all but the lower classes, a general education within the limits of their standard. These taken in connection with the vastness of the population are potentialities that must seem threatening to the industrial civilizations of the West.

Will these potentialities remain inert? I think they will not. Chinese thought and knowledge long ago reached a limit where it crystallized under the deductive philosophy. So it was in Europe till the time of Bacon, so too in Japan until under the influence of Western science the Japanese abandoned the philosophy of China and absorbing the inductive system remodeled their education and produced men eminent in scientific pursuits.

It will be strange indeed if China does not make the same

change, and with her commercial genius and stores of private wealth become a great center of twentieth century industry.

As regards the finer qualities on the moral side of human conduct, aside from the handicapping of altruism by the struggle for life, their limitations are perhaps due largely to two causes—to the absence of a religious faith and to the low position of woman. China seems never to have had a female deity—an all mother—but to have stopped with the conception of *Yin* and *Yang* in which the female element remained purely a biological factor. In the West the cult of the Virgin, the vows of chivalry and mediæval romances by idealizing woman began the process of raising her out of subjection. And personal observation assures me that the Chinese woman is quite capable of taking an ell for every inch of freedom the future may offer.

To return to my few typical observations: When in memory I see myself surrounded by thousands who circulate and try on, but return my hat, feel of my clothes and examine my watch—I knowing the while that violent protest means disaster, I realize that I was a strange animal being teased by children, but woe to the animal should he bite.

Another vision surges up when I see Murray, by quoting from Confucius the "Law of Hospitality" and the "Golden Rule," change to smiles the frowns of a threatening mob. I feel that there is common to all races a responsive chord that rightly touched reacts upon the innate good in man.

In the matter of honesty in trade one must remember that it is a long-established custom to drive a close bargain in buying and selling. And there exists the tacit understanding that an agent in any transaction receive a reasonable commission.

And when in memory I see the ragged little boy carrying away a banknote disappear a mile away into the mazes of Peking and then faithfully returning with the proper change

and the bread to feed the goldfishes I know that honesty enters into education among the poorer classes.

A kindly hospitality always welcomed me for nightly sojourn in the farmhouses of the North.

For one more instance in connection with the finer points of character let me recall to the reader the crowd of poor sufferers whose eyes my Russian medical companion had treated and who, after we had left the village, trudged after us with offerings to show their gratitude.

To come to the higher official class: The long friendly talks with the chief military and civil members of my escort, and with the members of the Foreign Office and those interviews at which I was an onlooker between Mr. Burlingame and the Regent Prince Kung and the Chief Statesman Wen-Siang, left in my memory the impression that they were men of a high order of intelligence.

The observations I have here cited are probably not sufficient for generalizations, but I think they throw light on important points in Chinese character under normal conditions and go to refute the oft-repeated denial of the existence of these traits.

The monotony of the voyage to Shanghai was relieved by one of my many narrow escapes. I was the only passenger. One evening as I sat smoking with the captain he leaned forward saying: "I smell smoke." I pointed to a cigarette burning among some paper in a spittoon. After a short time the captain exclaimed: "There *is* fire," and rushed to his room which opened from the saloon. And there was fire! In the rolling of the ship a towel swinging back and forth had caught on fire from a lamp. The fire had spread to the curtains around the bed and from there to the many rolls of charts on the racks under the ceiling. All were ablaze and no time to call for help.

The captain tore down the slender racks, covered the charts

with blankets and stamped on them. I threw water on burning woodwork, and trod the fire out of the remnants of curtains. It was a close shave. What was left of trousers between us didn't count; our skin would heal; but the ship was saved.

When I arrived at Shanghai my friend, Mr. Thomas Walsh, offered to make the journey homeward with me through Tartary and Siberia in the early autumn, a proposition which I eagerly accepted, as it was already late for the journey via India. Therefore I accepted his invitation to pass the summer of 1864 at the house of his brother, Mr. John G. Walsh, in Nagasaki.

Unfortunately, Japan was at this time shaken from north to south by its internal and foreign troubles, rendering it impossible for me to travel. But under the hospitable roof of my host the summer passed away pleasantly. Its quiet was broken only by the news of distant battles, and the rumors of threatened attacks upon the foreign settlements.

The political troubles rendering it impossible for Mr. Walsh to leave his affairs, the time of our departure was delayed until well on in October. In the meantime we made extensive preparations for a winter journey through a country of whose resources we knew nothing.

I fear that my readers will accuse us of an undue regard of luxury in traveling should I enumerate the quantities and varieties of provisions and drinkables which were boxed up for our journey, and stowed away on the brig which was chartered to take us to Tien-tsin. At the last moment, fearing lest the provisions already prepared, which were enough for forty instead of two, were not sufficient, Mr. Walsh sent on board an additional quantity and several cases of wines for the sea voyage.

The reason for this large amount of provisions and wines was that Mr. Walsh was going to Siberia to buy out the

Russian-American Company, and wished to keep open house during his stay in Irkutsk.

One day the Governor with his suite came to consult me in regard to controlling a stream that often overflowed in its lower course in the city where it had only a slight fall. Higher upstream its descent was rapid. Silt depositing in the lower stretch raised the bed of the stream.

I advised confining the stream between stone embankments where the slope flattened, so that it should scour instead of depositing silt. The Governor objected that the resistance caused by the embankment would make the stream overflow its banks far up the hill. He said that the impact of a continuous stream of water falling vertically on a stone is felt by the column all the way up.

Then to support his idea, he said in the most matter-of-fact way that he knew this from personal experience, and appealing to his officers for confirmation, he made a statement that it would not be proper to repeat.

CHAPTER XXXVI

THE TABLE-LAND OF CENTRAL ASIA

At last we bade good-by to Mr. J. G. Walsh and other good friends, and sailed out of the bay.

After a period of delightful weather we came in sight of the Korean island of Quelpart, and entered the Yellow Sea.

During several days nothing of interest occurred, excepting that the sea seemed alive with immense numbers of medusæ. The great disks of these animals, of two feet and more in diameter, were everywhere visible, floating like drab umbrellas near the surface, and as far as the eye could penetrate the water. The vessel often cut a way through great masses of them, leaving hundreds of their broken forms in its wake.

For days we passed through this immense shoal of jelly-fish, which must have covered an area of hundreds of square miles.

We were not deprived of an opportunity to study the habits of animal life within the walls of our vessel. The brig had been for a long time in the tropics, and had become thoroughly infested with cockroaches. They seemed to rival in numbers the medusæ outside; the floor, the ceiling, and the berths swarmed with them. After throwing several bushels of them into the sea, we were forced to conclude that, in so doing, we only made room for fresh and more hungry swarms from the hold. They were always first at table, turning up in every article of food, and sure to appear upon the most delicate morsels.

I had often heard that their favorite amusement was to gnaw off the toe-nails of sailors; and indeed, after my experience on this journey, I am ready to believe anything of

them, even the assertion that they form the principal ingredient in India soy, as they certainly were largely represented in our food.

A violent storm prevented our rounding the promontory of Shan-tung, and drove us north between the coast of Korea and the peninsula of Lian-tung, where we lay for several days before we could enter the Gulf of Pe-chili and reach the mouth of the Pei-ho. At last we disembarked at Tien-tsin and forwarded our supplies by boat to Peking, making the journey ourselves on horseback.

At the capital we were so fortunate as to make an addition to our party in the person of Mr. St. John, Secretary of the English legation. While waiting for the preparations which our new companion had to make we passed our time in getting carts, which we had enlarged to admit of sleeping, and in having our clothes lined with fur. General Vlangali, the Russian Minister, kindly placed a Cossack at our service for the journey, besides supplying us with numerous letters of introduction for Siberia.

On the morning of the 12th of November, 1864, we left the hospitable gates of Mr. Burlingame's house, to set out upon our long journey across the table-land of central Asia, and through Mongolia, Siberia and Russia, countries of which no one of our party spoke the languages.

As the gorge of Nankau is impassable for carts, we had ours taken to pieces and packed upon mules, as were all our supplies and baggage; it was quite a ride from the rear to the front of our long and straggling caravan. Stopping the first night at Sha-ho, we made an early start next morning, but before reaching Nan-kau Walsh's horse fell and sprained the ankle of his rider so badly that I feared we should have to give up the journey at its first stage, or take my friend back and leave him at Peking. But not daunted at the idea of making almost the longest land journey on the globe in

a crippled condition, and disregarding present pain, Walsh insisted upon being carried in a chair to Kalgan, where our carts were to begin their work.

At Nan-kau Walsh bought a wooden chair, which, slung between two poles and carried by strong men, formed a very convenient means of traveling.

Four days' journey from Peking brought us to Kalgan. Here we were detained four days in perfecting a contract with the Mongols, who were to take us to Kiachta. As we were bearing despatches, the Chinese Government had given

MONGOL PRINCE

MONGOL CAMELEER

us passports for Tartary, without which it would have been impossible to obtain either guides or camels. On the 21st of November, 1864, at four o'clock in the afternoon, we left Kalgan in a heavy snowstorm. The ascent to the summit of the plateau being too steep for camels to draw the carts, this work was done by horses as far as Borotsedji, which we reached at daylight, having slept in our carts. Here we found our camels, twenty-six in number, including those taken as reserves in case of accident.

The first work was the organization of the caravan; the carts, of which there were four, one for each, including Peter the Cossack, were intended for sleeping-places, as it was our intention to travel seventeen hours out of the twenty-four,

stopping only once to eat. The vehicles, mounted on two wheels and without springs, were less than three feet wide and about seven in length, and were covered with a housing of felt. They were closed with a door on one side, and furnished with abundant blankets and furs, and fitted with pockets without number. The long shafts in front were slung in loops suspended from the saddle of the camel, and a guide mounted on another animal accompanied each cart. The baggage was packed on eight or ten other camels, each animal having its nose pierced and fastened by a cord to the saddle of the one before it, the foremost being led by a mounted cameleer. Tied to the back of each cart walked a sturdy Mongol pony always saddled and ready to be mounted.

The ascent to the summit of the plateau, here between five and six thousand feet above the sea, brought us into a region of intense cold, which was rendered almost unsupportable by a strong north-northwest wind. The thermometer, which at Kalgan had ranged near the freezing point, stood here at 4° F. During the first night the cold burst all the bottles of light wines and champagne.

The wind, having a clear sweep over the plains lying between us and the Arctic region, blew with unbroken force, obliging us to take shelter in the carts while the preparations were being made for starting. Finally, when all was ready, the cameleers, enveloped in masses of sheepskin robes, mounted their animals and formed into line. During the first two or three days our whole time was occupied in endeavoring to find the best means to keep from freezing to death, a fate against which I saw we had not taken sufficient precaution. After we were for hours in the carts, there would be not more than three or four degrees difference between the inner and outer temperature. Although the vehicles were an excellent defense against the wind, woolen blankets and furs became so cold that it was painful to touch them with the naked

hand. It was not until the fourth day of our caravan journey that we were able to summon courage to face the fierce wind and clear cold. Sometime during the first night our route emerged from the flat-topped hills of the volcanic region of the plateau, and entered a country of gravelly plains, crossed by low granite ridges. Feeling a necessity for exercise we mounted our Tartar horses, and leaving the caravan, galloped in the direction of a small column of smoke rising from the neighboring hills. Reaching the top of a small eminence we saw in the valley beneath us a collection of *yurts*, from which herds were moving away to graze. A loud and fierce barking of dogs showed that we were already discovered, and as we approached the encampment a score of these savage brutes offered us battle, and we should certainly have been worsted had not their masters come to our rescue.

I had taken the precaution to bring an empty bottle and a paper of needles, which we immediately presented to the good woman of the tent. We had not long to wait for her gratitude. Putting a cauldron over the fire, she threw in some mutton fat, and after this had melted, poured in a quantity of water, to which, as soon as it had begun to boil, was added a liberal quantity of brick tea with salt and small pieces of the fat of a sheep's tail. When this was done, and a handful of parched millet sprinkled over the surface, the good woman served it up in lacquered wooden cups, putting into each one a lump of cheese, about the size of an egg. We stood almost aghast at the hospitable offering called forth by our presents: a decoction of tallow, tea, fat, salt, and cheese is certainly a formidable compound for a Western palate. But in spite of the way we reviled the mixture, in a language fortunately unintelligible to our hostess, the cups were repeatedly filled and as often emptied. Before we had left Mongolia, this Tartar tea had really become a favorite beverage with all of us.

We were now in a rolling country, or rather the true plateau, cut up by water-courses and the beds of generally empty lakes. Riding to the top of the hill we could distinguish our caravan winding along the bottom of the great valley, and some two or three miles ahead of us. Descending into this depression, we soon cut the tracks of the camels and cartwheels, which we had no difficulty in following. A great change had taken place in the weather, a light south wind keeping the mercury all day above freezing. Low hills of limestone and gypsum rose on all sides from the valley plain, covered with crystals of selenite which glistened in the sunlight. In the distance a horizontal line marked the limit where the cliffs of the table-land shut in the broad valley.

On the morning of the 27th of November we awoke in a rough country, among the hills of Mingan, a mass of metamorphosed sandstone, quartzite, and limestone. These hills, rising like islands from the table-land, and several hundred feet above its surface, are barren masses of rocks interspersed with patches of grass-covered soil. The western base sinks into the broad valley of Olannoor, while to the northwest we descended to the great steppe of Tamchin Tala.

This broad plain, which has suffered but little from erosion, has a surface of gravel and sand, with scattered patches of grass. Pebbles of chalcedony, agate, and cornelian are strewn among the gravel. The table-land, at least along the whole line of our journey, is utterly destitute of trees, and the first and only perennial which I saw was a low, thorny bush, which appears on the Tamchin Tala, and other equally barren soils. From the hilltops one overlooks an immense area of plains or undulating country as boundless and unbroken as the ocean. In the summer, we were told, this is covered with a waving mass of tall grass, forming a green mantle, which toward the distant horizon becomes a deep blue. In the

winter the scene is entirely changed. The plains and low hills, yellow from the color of the gravel and dead grass, have all the appearance of a boundless desert. But little snow falls on the table-land, and that little soon disappears, drifted into depressions or evaporated by the intensely dry atmosphere. But the little snow that falls is one of the worst enemies of the traveler. Frozen into a fine, sharp sand, it is driven with cutting violence before the strong north wind, blinding for the time men and animals. Lifted by the whirlwind from the ground, it sweeps over the surface in eddying clouds, sinking or rising with the varying force of the blast, now deeply covering large areas and soon leaving them again barren surfaces. Seen during one of these *bourans,* the plains have all the appearance of ice-seas lashed by the fierce snow-storms of an Arctic winter. Such is the plain of Tamchin Tala whence Genghis-Khan started to conquer the Eastern world.

When we came up with our caravan we found it already encamped, and we began cooking our single daily meal. We were in the habit of stopping about an hour before sunset, to give the animals a rest of six or seven hours out of the twenty-four.

One large tent answered for the whole party. In the middle the Mongols put up their tripod and cauldron, and another fireplace for our own cooking. We now spread over the country, one party in search of snow, the other to forage for argols (dried camel dung) for fire. It was not always an easy matter to find enough of either of these necessary articles for cooking. Soups were our great forte; to this all our energies were directed, and it was made the subject of experiments. Obtaining a kettle of water by melting snow, we first put into it such frozen vegetables as we had brought from Kalgan, and then such fresh meat—mutton, horse, or cow—as we could get from the Mongols, without being over-

scrupulous as to the manner of its death. Adding to these a pound or so of fat of the sheep's tail, allowing the whole to cook, we put into the cauldron one tin each of peas, beans, ox-tail soup, mock-turtle soup, frankfort sausages, salmon, and tomatoes. How this compound would taste in civilization it would be hard to say; but no dinner at the Trois Frères, or at Delmonico's, ever disappeared with greater relish than these four o'clock meals on the steppes of Tartary. And they were well earned, for although we had to work hard in cooking them, we often had to work still harder to keep from freezing while eating them. The tent offered slight protection against the cold winds, and the argol fires gave no warmth at the distance of a few inches.

Consequently, in a strong wind, with the mercury at 10° or 20° F., we were obliged after every few mouthfuls to jump up and run to renew the circulation. Owing to these interruptions the evening was generally far advanced before we reached the bottom of the liberal cauldron. Even this ample dish was not always sufficient to satisfy appetites of twenty-four hours' growth, which had been whetted by the cold air and constant exercise.

As it was only by rare accident that we were able to get a cup of Mongol tea in the morning, we studied various methods of keeping coffee in a fluid state during the night. The day of the thermos bottle was still nearly half a century off. So each of us took a bottleful of boiling coffee and rolled it carefully in a large blanket; then, thrusting the precious bundle under his fur cloak, each man rushed to his cart, and, diving under the bedclothes, carefully hugged his charge all night. Even a baby could not have been treated more tenderly. In this way we generally succeeded in having a bottle of iced coffee on awakening in the morning; but woe to the unhappy man made restless by an over-hearty dinner. His neglected bottle, to which he looked for consolation, would

be frozen, perhaps burst, or, at the very best, the coffee was a mass of needles.

On the morning of the twenty-eighth we were still traversing the Tamchin Tala. There was no wind, and the thermometer stood at +24° F. As the morning wore on we could see that we were approaching a change in the character of the surface.

Before noon we had reached the edge of a cliff which formed a perpendicular wall, 150 or 200 feet high, overlooking a large depression like the abandoned valley of a river or of a long lake. The exposure in the cliff showed the plateau here to consist of horizontal strata of coarse and fine sandstones with calcareous cement, containing many fragments of chalcedony and agate. On the bank of a small creek stood a small collection of *yurts,* which seemed more permanently established than are generally the habitations of this wandering people. After traveling several miles in this valley, which must be very beautiful in summer, we arose to the table-land on the opposite side. The country was here rolling, and evidently well covered with grass in summer. Hardly had we put up a tent before a number of women and children appeared with baskets of argols, which they gave to our cameleers. The children had several strings of agates, which they parted with for some pieces of brick tea. The gift of the argols was not prompted by pure hospitality, as I had supposed.

While our Mongols were cooking their mess, the newcomers sat with eager eyes just inside the door of the tent. Our cameleers had a cauldron filled with large pieces of beef, which I strongly suspected of having belonged to the frozen carcass of a cow we had passed that morning. Almost before the meat was warmed through our men seized enormous pieces, and began the meal by cramming into the mouth as much of one corner of the piece as could be got in, and then

sawing off the rest just outside the lips. Their throats seemed made of India rubber, so rapidly did one large piece disappear after another.

Indeed it is hard to understand why the Tartars are endowed with molars. Altogether carnivorous, they used their teeth, so far as I could discover, only for tearing off their food. Although most Mongols carry a pair of chop-sticks slung in their girdles, they can only be for ornament, as I certainly never saw them use them. In cooking, no part of the animal is lost, and they are not over-regardful of cleanliness in preparing their meat for the pot.

Every now and then our chief cameleer, taking from the cauldron a piece, generally one of the poorest, tossed it across the tent to the ravenous assemblage of women and children.

This man was a Lama, and had traveled not only through Tartary and northern China, but had been to the shrine of Tsongkaba, and had knelt before the Grand Lama at Lhassa. Fat, and with as jolly a face as even a priest could wish, our good-natured Lama, while telling the beads of his rosary, or repeating the monotonous Buddhist formula, wore an expression of most perfect contentment and might have sat as model for a statue of Buddha in *Nirvana*.

The next morning was comparatively pleasant, with a south-west wind and the thermometer at +17° F. The road lay through an uneven country among low granite hills. During the afternoon we crossed the boundary between inner and outer Mongolia. This limit is marked by rough piles of stones. Thus far we had been traveling through the land of the Sunite Tartars, while north of the boundary we would be in the country of the Kalkas, under the rule of the Khans of Tushetu and Tsetsen.

The Sunites are looked down upon by the Kalkas, who border them on the north and on the southwest, for thus far

we had rarely seen encampments of more than five or six *yurts;* the herds looked small and their owners had the appearance of extreme poverty.

Near our camp, which was a few miles north of the boundary, I picked up a piece of petrified wood, a thing apparently of not uncommon occurrence in this region. In Peking, several pieces of silicified wood were shown me under the name of Han-Hai-Shi or gobi stone.

In looking for snow I came not far from our camp upon a well, at which large numbers of animals were being watered. It was dug in an isolated depression, was only a few feet deep, and walled with stone.

The morning of November 30th opened with a northwest wind and the thermometer at +15° F. We found ourselves in a hilly country, near the place marked on maps as Arshantyi. The hills consist mainly of clay slates. After traversing these for some time we came upon a broad, dry, gravelly water-course, which, descending to the west, below low granite cliffs, widens out in the valley of the Olannoor. These granite hills are bare of soil, and devoid of any vegetation, with the remarkable exception of two or three stunted trees, growing in crevices of the rock. These were the first and only trees we saw on the plateau. On some maps there was marked a town called Goshun somewhere in this neighborhood, so we set out to find it. Its name suggested "the land of Goshen."

After passing the first hill we saw a large herd of antelopes quietly grazing in the valley below us; but we being to windward they scented us, and were soon out of sight. After a further ride of two or three miles we came upon the object of our search, which, instead of being a large village, consisted of only two or three *yurts.* Still, we breakfasted luxuriously on Tartar tea and lumps of boiled fat of sheeps' tails. This part of the Tartar sheep is considered a great

delicacy through all Asia, and is really almost equal to marrow. The tail of this animal in Tartary attains a weight of from thirty to fifty pounds, all pure fat. Seen from behind, the animal is all tail; and, when the appendage attains its largest dimensions, it becomes necessary to attach a contrivance by which the animal can conveniently carry his own tail without allowing it to drag. This is sometimes effected by a couple of sticks fastened at one end to the sheep, and spread out at the other, dragging upon the ground while supporting the tail. This growth of fat seems to be peculiar to the table-land, for it is said that the same breed, when taken to India, soon loses the peculiarity. It may perhaps serve the same purpose as the hump of the camel, that of supplying in time of plenty an abundant store of fat, upon which the animal can subsist through a season of deep snow, when it would otherwise starve.

When the English troops occupied Afghanistan the soldiers became so partial to the tails of these sheep that they almost entirely discarded the meat. The result was a congestion of fat in the intestines, which caused mortality in the army. Fortunately, as our stay was short, we had not heard of this fact when we traveled in Tartary.

At Goshun we bought of the good woman of the tent a liberal supply of cream, put up like immense sausages. As it was frozen it was easily carried, slung to the saddle, without danger of being churned into butter.

We were obliged to go into camp several hours earlier than usual, in order to wait the return of our chief cameleer, who had gone to hunt for two camels which had strayed away.

Although secured by strings passed through the nose, the camel will sometimes tear out the flesh, and, once away from the caravan, will often give his pursuer a good chase. Still, the Tartar or Bactrian camel is far more docile than his brother of Egypt and southwestern Asia. Much larger than

the Southern camel, he is provided with a heavy coat of long hair, and with two humps, which, after a season of grazing, stand great cones of fat upon his back, forming the most comfortable of saddles.

Most people are accustomed to associate the camel only with tropical climates. The Bactrian species is of little use during the hot season, while during the coldest winter it performs nearly all the labor of transportation in Central Asia. In countless caravans these patient animals traverse the frozen deserts of the table-land, and descend into the region of deep snows and intense cold of southern Siberia.

The spongy and pliable soles of their feet, armed with claw-shaped nails, are adapted only to walking over sand. Rocky or gravelly surfaces soon wear out the thick skin of the foot, while on mud or ice they find poor foothold.

Even in many parts of Mongolia the caravan routes are gravelly, and wearing to the camels, but in northern China, where large numbers of camels are used in transporting coal, their life is one of torture.

While waiting for the return of our Lama we witnessed the operation of resoling or rather patching the soles of a camel's foot, where a hole about an inch in diameter had been worn through to the quick. The animal was thrown on his side. His four feet bound tightly together, and his head tied back near the humps, he was held motionless. After the wound was cleaned out, a piece of softened raw cowhide was sewed to the skin of the foot, two or three stitches being taken on each side of the piece. The hind feet seemed to suffer most, and the operation had to be renewed every few days.

While roaming among the hills, not far from our camp, we came to a well, at which great herds of camels, horses, oxen, sheep, and goats were being watered. To us the most interesting and novel part of the assemblage were the young camels. Even the smallest showed the staid and sober bearing

of its race, and none of the exuberant friskiness common to young colts and calves.

Although the thermometer was so low we experienced no inconvenience from the cold, partly owing to the absence of wind and partly to the clear sun. I doubt whether any one who has not wintered on the plains in the interior of a northern continent can appreciate the feelings which led the early inhabitants of Central Asia to love and worship the sun. In the intense cold of an elevated region, the plains of which, unprotected by forests, are open to the almost perpetual blast of the polar wind, life would be unbearable without the quickening influence of an unclouded sun. The atmosphere of Central Asia is intensely dry, because the winds reach it from every direction only after having deposited their moisture on the broad belt of lowlands and the high mountain peaks which intervene between the table-lands and the oceans; thus, especially in winter, the sun rises, runs through its daily course, and sets, an unobscured disk, whose rays suffering a minimum of refraction, arrive at the surface with a greater degree of warmth than would obtain in moister regions in the same latitude.

Often in this journey, in traveling northward, facing the strong Arctic winds, with a thermometer at 10° and 20° F. below zero, while almost ready to drop from the saddle, owing to stiffness from cold, I have turned my horse to face the sun, and have felt in a few minutes the warmth of its rays stealing gently through my veins, like an influx of fresh vigor. The heavy icicles formed by condensations of the breath upon the beard would gradually loosen, and the ice slowly disappear. How often have I then felt that, had I been born a nomad, I should have fallen down to worship the great light-giving god of day, as did the earliest bards, the authors of the Vedas.

During the night there fell two inches of snow, and when we mounted our horses in the morning we had to face a fear-

fully cold wind and the eddying clouds of snow, which, driven like sand, fairly cut the face. It was a hard day for man and beast. The long train of camels reluctantly faced the blinding force of the storm, and we made but little progress.

During the afternoon the plain began gradually to descend, and finally ended among low ridges of granite.

At night the storm increased in violence till it blew a very hurricane, putting out of the question all thought of starting in the morning.

The cold also increased to such an extent that there was danger of freezing, even in the carts. When daylight came our blankets were covered with snow, from the condensed moisture of the breath. For some time past our bedding had become frozen stiff from the same cause. During the 4th of December the thermometer stood at 3° F., but the continued force of the hurricane kept us encamped.

We were at a small group of Mongol *yurts*, called Buteryn Chelu, half-way between Kalgan and Kiachta. We passed the day endeavoring to thaw out and dry our blankets and furs over the argol fires. The next day, with an abated wind, we continued our journey and encamped at a place called Huri, among some hills.

For several days we had seen before us a mountain peak, which in the clear atmosphere of the plains seemed so near that we each day thought to pass it before night; but each morning it stood still beyond us, towering higher than on the previous day. On the afternoon of the sixth we approached the base of this picturesque height, which is called the Bogdo Oola, or Sacred Mountain. From a broad terrace, which forms its footslope, a large valley was visible in the southwest, threaded by a winding frozen river, the Russ Gol.

While crossing this plain an accident occurred which might have produced serious results. A cameleer in charge of the carts had fallen asleep in the saddle, and the animals, taking

advantage of this, had strayed on to uneven ground, where they could browse, while lazily moving forward. In making a short descent one of the carts was upset, breaking one of the shafts. We all rushed to the spot, and while attempting to right the vehicle a violent altercation arose between the owner of the cart and the Mongol whose stupid negligence had caused the accident. The foreigner, finding that strong English produced no impression on the Mongol, endeavored to enforce his meaning by well-directed lumps of ice, which fell harmlessly upon the quadruple thickness of sheepskins which incased the cameleer; not so, however, when returned with increased force upon the simply woolen-clad foreigner. In self-defense the latter now drew his revolver. It happened that a considerable number of Mongols from the neighboring village were standing by, laughing at the unequal odds of the battle; but when they saw the pistol, they drew their long knives, to use them in defense of their fellow countryman. The situation seemed to be growing very serious, when another matter called for the attention of all parties.

Frightened by the noise, the camel drawing St. John's cart had turned and fled. We could see the cart dashing at full tilt over the rocky plain, now swaying from side to side, now bounding high in the air. Soon the wheels left the body, and the contents of the cart were flying in all directions.

This turn of affairs was so ludicrous that even the owner of the cart could not help laughing lustily. But when it occurred to him that all his money, in gold, for the long journey through a strange land, was in one of the slender cloth pockets of the vehicle, the matter appeared in a more serious light. Twenty or thirty Mongols were already in advance of us, picking up the scattered articles, and there seemed no likelihood of recovering the money. When we reached the cart, we found the pocket torn and the treasure gone. It was of course natural to suspect our visitors of

having appropriated the coin to their own use, and it was proposed that we should forcibly search them—certainly not a very easy thing to be accomplished with impunity by four foreigners, upon two score of Mongols, in the heart of Central Asia.

While we were discussing the matter among ourselves, a loud shout was heard from a strange Mongol, who was digging all alone some distance back in the track of the cart.

Hurrying to the spot, he pointed out a pile of shining sovereigns, which would have been an immense fortune to him, but which he had carefully gathered together out of the sand, in which they had been buried by the blankets dragging behind the cart, and which he triumphantly handed over to the owner. Not one was missing. St. John rewarded the man liberally, and from that time we all of us had a higher opinion of the honesty of this simple people. Theft, I believe, is a thing of rare occurrence among them. They will over-reach in bargains, but the Buddhist commandment—"Thou shalt not steal"—is, perhaps, more generally observed than is that of our own religion in more civilized countries.

The next day was passed in repairing the carts. Although it was cold the absence of wind rendered the day not unpleasant; but owing to the bad road and the weak condition of one of the carts, we made but little progress. Encamping early, we lay over till the next day.

When I awoke in the morning the thermometer was at 20° F., and the fierce blasts of wind which whistled around the carts, causing them to sway to and fro, bespoke a hard day's work. It was too cold to remain inactive in the carts, between the icy blankets; and the resistance offered by the north wind rendered it very difficult to walk for any considerable stretch. Our only resource in such places was to mount our horses, which were already much fatigued by traveling seventeen hours daily. None but animals born on

these plains could have endured the hardships of such a journey; but the large Mongol ponies, covered with a long, shaggy coat of hair, patiently followed the carts, to which they were tied at night, and carried us during the greater part of the day.

For a whole week at a time, often getting no other water than the little snow that they could pick up when our route passed a drift, and, excepting a handful of barley, with no other food than a little frozen grass during the hour before sunset, these patient brutes served us well through the whole of our journey to the Siberian frontier.

Toward evening we suddenly came to the brow of a hill, and saw the Lamasery town of Churin Chelu. The light of the setting sun was reflected back from the gilded spires and balls of the temples, producing an effect as startling as it was unexpected in the middle of the Gobi desert. The place has perhaps a hundred houses, many large *yurts*, and several fine temples. The houses are built of wood, brought from Urga, beyond the northern edge of the plateau. As we passed through the village the streets were filled with Lamas, in their colored dresses, and the evening air bore the sound of the chanted vespers from the temples.

The next day was very cold —20° F., with a strong north wind. It seemed as though we could not possibly reach Siberia without having some parts of our bodies frozen. Long and swinging icicles hung from the shaggy coats of camels and horses, producing a strange tinkling sound at every step. During this morning the ice accumulated on my beard until it hung in a mass nearly a foot long, and of no inconsiderable weight. Even the mouthpiece of my pipe became fixed in the ice formed on my moustache. Turning my back to the wind, a few minutes' exposure to the sun removed these icicles, but they soon formed again.

During the day we passed through a small village, where

the *yurts* were very large, and had wooden vestibules. Entering one of these we found it roomy and warm. It was occupied by two Lamas, who gave us tea in return for tobacco. They were much interested in my pipe, which represented the head of a heavily bearded Zouave, and which they took to be a portrait of myself—a rather doubtful compliment. We had already passed the middle of the desert, and the country had now a general ascent toward the north.

We had reached the northern edge of the plateau of Central Asia. We had crossed the Gobi desert.

I have given elsewhere my observations on the geology of southern Mongolia and along my route across the plateau, so I will here state briefly the general result as I conceived it to be.

My observations had shown that throughout my route the substructure of this table-land consisted of very old folded metamorphic and intrusive rocks in which a deep depression occupying most of its width had been filled with horizontal strata, several hundred feet thick, of very much younger unmetamorphosal rocks of clearly salt water origin. Out of this younger formation rise hills of the older rocks, evidently islands, former islands in a now vanished sea.

The Gobi desert extends 2,000 miles westward, from the western border of Manchuria, to where it ends in two branches —one between the Altai and Tienshan mountains, the other between the Tienshan and Kwen-lun mountains. From it the surface rises to about 4,000 feet on its northern edge near Urga, and to about 5,000 feet on the southern edge near Kalgan.

From the character and extent of the horizontal strata I concluded that at no very remote geological period the flat-lying strata had been deposited in a sea contemporaneous with the great body of water that extended from the Arctic Ocean to the Caspian Sea.

Richthofen found my hypothesis confirmed by his analysis of Stolicka's later observations in the western end of the Gobi, and he concluded that the sea occupied the Gobi depression at the end of the Cretaceous period.

The intensely dry climate having dried the sea left the region a vast desert. First the loose débris and later the bed-rock were scoured by the winds and distributed—the sand as dunes, the dust as loess to nourish grasses on the northern and southern borders of the depression. These grasses made possible both an extensive development of nomad life and the ability of successive hordes to sweep fatefully westward to Europe.

On the other hand the obstacles opposed to the movement of a non-nomad army were shown in the Chinese campaign to recover Chinese Turkestan after the Mohammedan rebellion of 1863. During this war the Mohammedan population of Turkestan had, under Yacub-Khan, massacred the Chinese inhabitants. A Chinese general organized an army for re-conquest. It took him twelve years to cross the desert. The first year his army raised supplies on the southern border to last till reaching an oasis where cultivation was repeated. This was done on successive oases until in the twelfth year he emerged at his destination and exterminated nearly all of the Mohammedan occupants.

On the 10th we camped on the plain of Borudzurintala over which we had traveled all day. The surface was covered with abundant dead grass. The next morning we awoke in a hilly country. Flat-topped hills of volcanic rock seemed to indicate the existence on the northern edge of the plateau of a volcanic region, corresponding to that of the southern escarpment.

The next day the country had changed its character, and we found ourselves ascending a broad valley, with sweeping vertical and horizontal curves, bordered by round-topped hills.

The soil of the valley and hill-slopes was a rich black earth, different from anything seen on the rest of the plateau. We were here in the Horteryn-Daban (Daban Mountain). During the following night we felt, from the motion of the carts, that we were going downhill, and morning found us descending a flat gravelly plain or valley, inclosed between hills from 300 to 500 feet high. We were leaving the elevated continental basin of Central Asia and descending among the mountains of its northern border. The sides of some of them were clothed with pine forests, which, though a novel sight to us, gave an air of gloom to the country.

Among these hills we came upon the sacred city of Urga. Urga, or Kuren, is the seat of one of the four or five living Buddhas, who, subject to the Dalai Lama, rule the inhabitants of Mongolia and Thibet. This Grand Lama was as usual a Thibetan, and only sixteen years old. The palace in which he lives has a roof highly ornamented with gilded spires and balls. It was to Urga that the Dalai Lama fled from Lhassa when Younghusband invaded Thibet.

There was a Russian Consul at Urga, to whom we had letters of introduction. His house was a large, two-story building, constructed of logs, hewn to a plain surface, outside and in, well painted without, and with a carefully furnished interior. Before reaching the Consulate our chief cameleer rushed up to me and began to rub my face vigorously with snow. My nose was frozen, and he was thawing out the frost. I soon began to feel the effects. It was many days before I was freed from the pain and swelling.

M. Chischmareff being absent, we were politely received by his wife and the secretary.

On the 13th we took a walk through the city, which had a population of 16,000, of which one-half were Lamas. We saw many large buildings, most of them of unfamiliar shapes, and one built exactly like a *yurt*, but of great size,

being, I should think, thirty or forty feet high, and sixty or seventy in diameter. I didn't learn its use. Entering one large temple we saw an immense image of Buddha, apparently of wood covered with sheets of gilded copper. The proportions are well preserved throughout the statue, and some idea of its size may be formed from that of the great toe, which was more than eighteen inches in length. This image, though well finished, does not compare, as a work of art, with the Daibutz at Kamakura. In front of this temple, as well as of the other, there were many cylinders, or praying machines.

It has often been asserted that the ritualism of the European Church is a direct offshoot of Thibetan Buddhism. The resemblance is so strong in many of the details of both that Abbé Huc, a Roman missionary well versed in the history and religion of Thibet, could find no better way of accounting for the similarity than supposing it to be an artifice of Satan, invented to bring disgrace upon the Holy Church.

But these praying machines are a refinement which not even the extremists of the West have adopted. Even the simple crank motion has been improved upon by the ingenious Lamas, who attach the cylinders to windmills and water-wheels. The worshiper, setting one of these in motion, goes on his way with the assurance that every revolution of the cylinder turns out a large number of prayers for his benefit. The advantages of this over the rosary, which they use also, are obvious.

The Buddhist faith was introduced into Mongolia directly from Thibet, and probably at a time when the religion had already received those characteristics which distinguish the Thibetan form so widely from the Indian, Chinese, and Japanese.

From a social point the influence of the humane doctrines of Buddha is most marked among the Mongolians, whose character they seem to have molded as much as Moham-

"ON-THE-HEIGHTS." THE STUDIO

From a photograph by Emily Redina Kempson

medanism has that of the Kirgis tribes further west. To-day we would not recognize in the Mongols the race which, under the leadership of Genghis-Khan and his descendants, overthrew the dynasties of all Asia and of eastern Europe, sending terror even to the shores of the Atlantic. This people, once a scourge of humanity, is now perhaps the most peaceable upon the globe.

The Chinese court, mindful of their struggles with these northern neighbors, has craftily taken advantage of the influence of Buddhism upon their character. During centuries it fostered Lama Buddhism, encouraging in every manner the multiplication of Lamaseries and monasteries; thus, by largely increasing the number of priests (who are not allowed to marry), it also kept up a constant drain upon the male population to supply the Chinese army with soldiers, both in rebellions and wars with foreigners. But the draft into the priesthood operated the most powerfully in keeping down population. At present, in every family, one and often several of the males become Lamas at an early age. This immense army of drones lives, of course, off the substance of the remaining population. The Lamas pass their time in Lamaseries, or in roaming through Tartary and Thibet, serving the wants of the native superstitions, and practising all the arts of a crafty priesthood. The numerous festivals which took place at the monasteries attract immense crowds of the devout laity, who often return to their homes impoverished by the offerings of large herds and treasure which they had been called upon to make.

On the 14th of December we left Urga for Kiachta. The turn in the road brought us into a valley tributary to the Tola. Some distance before us two buildings of great size, one on each slope, commanded the valley. They are built on high terraces; and one of them, constructed in the Thibetan style, which was slightly inclining toward the top, was cer-

tainly the most sepulchral and gloomy structure I had ever seen.

From this valley we passed over a high and steep hill, where the carts had to be drawn by oxen and led by women.

The next day, while riding in a temperature of —4° F. we saw coming toward us a train of camels and carts, in front of which rode two Europeans. These proved to be M. Popoff, of the Russian legation of Peking, and his bride, a Russian lady whom he was now taking to China. Mounted on a good horse, and thoroughly protected by furs, this lady assured us that she did not dread either the cold or the hardships of the long journey that lay before her. Fortunately, as they were going south, they escaped facing the almost constant north wind, which is the most disagreeable part of the climate.

The next day, with the thermometer at —8° F. I noted pine forests, but only on northern flanks of hills.

On the seventeenth we awoke in a country of plains and hills, the latter having the appearance of an archipelago of small, rocky islands rising out of an extensive steppe. We encamped at Bain Gol, and were soon visited by a large number of Mongols. Considering the sameness of life, of climate, and pursuits, which exists throughout Mongolia, it is remarkable that this people should show the diversity of types of faces that we find among them. Certain characteristics are common to them all. Of medium stature, rather above that of the northern Chinese, they had the almond eyes, prominent cheek-bones, scanty beard without side-whiskers, which are all marked points of the Mongolian race. There is, perhaps, more diversity in the nose than in any other feature.

Among the women at Bain Gol I noticed some with regular, and others with really aquiline noses, though in general the nose had so little prominence that, when looked for in profile, it was entirely hidden by the prominent cheeks. If I were asked to define the difference between the Chinese and Mon-

golian face, I should say that the features were the same, though more delicately chiseled and softened down in the Chinaman; and in China this difference increases, until in the southern provinces we find the same features formed in a much more effeminate mold, while the people are also much smaller in stature.

While we were at Bain Gol several trains of small carts, drawn by oxen, passed us on their way south, carrying millet, which seemed to be the only grain used by the Mongols. In summer the transportation was carried on almost entirely by oxen.

The next two days the mountains bordering our route appeared to be higher; and in the forests with which they were covered there appeared an increasing number of deciduous trees, particularly the white birch.

The Mongol villages through which we now passed had a more permanent character than those of the plains, the houses being more generally built of logs, and surrounded with some cultivated land.

On the morning of the 21st, as we emerged from the forest on the northern slope, the Mongols called our attention to a group of houses and spires, which lay on the opposite side of a broad plain stretched out before us. This was the double city of Kiachta and Mai-mai-chin.

About noon we reached the latter, which, lying on the Mongolian side of the frontier, was entirely Chinese in character, as it was also the principal frontier market town of the Empire. In traversing its narrow streets, between rows of Chinese houses, and threading our way among neatly-dressed Chinamen, we could almost imagine ourselves again south of the Great Wall.

Entering a large open place, we found several caravans, some encamped, others just coming or leaving, and after some little delay, in having our passports examined by Chinese

officials, we were permitted to pass the wall which separates the two towns. One can hardly imagine a sharper line than is here drawn. On one side of the stockade wall the houses, churches, and people are European; on the other, Chinese. With one step the traveler passes really from Asia and Asiatic customs and languages into a refined European society.

CHAPTER XXXVII

SIBERIA

Our first step after we arrived at Kiachta was to present our passports and letter to M. Pfaffius, Commissioner of the Frontier. From this gentleman and his wife we had a cordial reception, and an invitation to dinner the next day. The Russian Minister to China had kindly written in advance of our coming, and we found that M. Garnier, with whom I had traveled the previous year to Peking, had prepared quarters for us at the town of Troitzkozavsk, about four miles distant, whither we immediately went. It was no easy task to transform ourselves into the semblance of decent Europeans. For nearly six weeks we had been unable to make any change of clothes, and our only ablutions had been an occasional wash of face and hands with greasy soup, as a preventive against chapping.

Our long exposure to the intense cold of the plateau rendered the heat—usually 75° or 80° F.—of Russian houses almost unbearable. By opening the wind-wheel ventilators, which pass through the upper panes of the double-glazed windows, we reduced the temperature to forty-five degrees, but even this was at first oppressive. Soon after our arrival we were told that the bathhouse was heated. We were shown into an outer room and, after undressing, into another filled with steam. In one corner a large oven, containing a quantity of cobble stones, had been heated for several hours. Into this a servant dashed a pailful of water, which, immediately becoming steam, filled the room. This process of bathing, which was at first so disagreeable as to be almost painful, we soon

learned to regard as a luxury, and there is certainly nothing more refreshing. The next day, after paying the Mongols and discharging the Cossack, we drove over to Kiachta to dine with M. Pfaffius, and after dinner sat down to cards, the principal amusement of the country.

Among the company was Colonel Buthets, who was sent by his Government in 1842 to the United States to engage Mr. Whistler as chief engineer of the railroad between St. Petersburg and Moscow. Colonel Buthets, who was now working gold placers, informed me that one and one-half pennyweights of gold to a ton of earth was considered rich.

His workings, which were in the district east of Kiachta, were in and near the beds of mountain creeks. The earth was here almost always frozen, and the gold could be gained only by breaking up the ground in winter and working it in summer, after the exposed heaps had thawed.

When associated with much clay, it was broken up by passing it with a stream of water through a revolving drum in which it remained a longer or shorter time, according to its consistency; from this it passed over tables of various forms, where the gold was collected.

The valleys on the northern slope of the Yablonoi Mountain seemed to abound in auriferous localities. In the valley of the Olekma River, a tributary of the Lena, the water, confined under a heavy pressure every year by ice, bursts its covering, flows over and freezes upon the surrounding country, until toward the end of winter the accumulation of frozen overflows have a thickness of from ten to twenty feet. This covering, and the fact that the earth between it and the pay-dirt never thaws, rendered the working very difficult.

While at Troitzkozavsk we visited the bazaar to buy furs for our journey through Siberia. The skin most generally used by gentlemen was that of the *genette,* or American racoon. It is imported mostly from the United States. A

superior robe of this cost about 200 roubles, which was equal to $150. The fur of the sable was worth from 25 roubles upwards apiece; the finest qualities readily brought 50, 100, or even 200 roubles.

A considerable quantity of American tobacco, under the name of "Maryland," was imported for the manufacture of ladies' cigarettes, while the material for men's smoking was brought from Turkey, although a good deal of inferior tobacco was raised in different parts of Siberia.

On the Russian Christmas day we drove over in the evening to dine with M. Pfaffius. As there is rarely enough snow for sleighing in this part of Siberia, south of Lake Baikal, the inhabitants rely altogether upon wheeled vehicles. This evening St. John and I drove alone. We had hardly gone over half the road when something happened that brought us to a standstill. While we were trying to repair the damage, we saw a group approaching us with evident interest. The bright moonlight, which lit the open plains far and near, revealed several wolves, which were rapidly approaching. Suddenly they stopped on a small eminence close at hand, as if to take a good look at us. Their large, shaggy forms, defined against the sky, were not pleasantly suggestive considering that we had neither arms to fight, nor means of getting away. Our memories recalled long-forgotten stories of Russian wolves, including that of the mother who saved the lives of herself and one or two children by throwing out of the sleigh, one by one, the other members of her family. Dashing toward the group, we waved our hands and shouted a duet, which took our visitors so completely by surprise that they turned tail and trotted off at a quick pace, stopping, after the manner of wolves, every few rods to look back.

The ease with which this victory was accomplished surprised us quite as much as our chorus did the enemy. We lost a long-cherished respect for Russian wolves.

At dinner we met, among others, a man who was by birth a full-blooded Buriat Mongol, and whose face was marked by the extremest characteristics of his race, who was, nevertheless, well educated, and struck me as in no respect inferior to the Europeans by whom he was surrounded. After dinner the whole party drove over to the club at Kiachta, a large building with rooms for dancing, conversation, reading, billiards, and the inevitable buffet, which everywhere in Russia assumes an importance unknown elsewhere. The company, of both sexes, seemed to divide their time between dancing and playing cards, with rather stronger inclinations to the latter. Among the dancers was an officer who had lost one leg in the Crimea, a circumstance which did not prevent his going skilfully with wooden leg and crutch, through a quadrille.

During our stay at Kiachta we accepted an invitation from Major Muravieff, nephew of the former Governor-General, to accompany him to his headquarters at Kudara. This officer, to whom we were indebted then, and later, for many favors, was in command of the Cossacks, along 600 miles of the frontier. The distance to Kudara was about forty miles, which we traversed in little over three hours. There being no snow on the ground we traveled in a "tarantass," a four-wheeled vehicle, constructed on the principle of the buck-board wagon, being a box slung on long poles in lieu of springs, and drawn by as many horses harnessed abreast as the passenger chose to pay for. We found a large village surrounding the well-built and elegantly-furnished quarters of our host. The inhabitants were all Cossacks, part of the frontier guard established by Peter the Great, for the double purpose of settling and defending the outskirts of the Empire. Being at the same time soldiers and farmers, they enjoyed with their families many privileges guaranteed to them by the edicts of their founder, and his successors. The number

of this population under the command of Major Muravieff was about 17,000.

We arrived at Kudara during a festival, and in the evening went with the Major through the village to see the amusements of the people. Hearing a sound of music and singing in one of the houses, we went in. In the unheated vestibule a shower of snow was falling, caused by the continuous condensation of the moisture which found its way through the cracks of the door from the crowded room within. Entering it we passed at once from a temperature of 30° F. below zero to more than 100 above, and found ourselves in an assemblage of Cossack men and women who were just beginning a national dance, and the three prettiest belles of the room were detailed to select us as partners. This dance began with a slow promenade of the ladies, who then separated and chose partners, with whom they marched up and down the room, each lady chanting the praises of her companion, winding up by kissing him on the forehead and on each cheek, and singing at the same time: "Therefore I will kiss him thrice, in the name of the Father, Son, and Holy Ghost," an invocation rather adapted to take away from the individual emphasis of the salutation. Then they separated, and the men in their turn chose their partners, and after praising their beauty and excellence, repeated the kissing, which seemed to be the chief purpose of the ceremony. The music and songs of the Cossacks were full of melody, though of a weird and barbaric kind.

While at Kudara, Major Muravieff organized for our amusement a white-hare battue, from which we brought back several good specimens of the fur of this Arctic animal. The next day we returned to Troitzkozavsk.

The eve of the Russian New Year we spent at a ball, at the house of M. Sabasnikoff, the leading merchant of Kiachta. Here we saw so much refinement and elegance, as well as

beauty, among the ladies that it was difficult to remember that we were in eastern Asia, and on the confines of Tartary. Here, too, we enjoyed the same dance which we had seen at Kudara. While at Troitzkozavsk I passed much time in studying the collection of M. Nicholas Popoff, to whom I was indebted for much interesting information about the mineralogy of eastern Siberia, and bought from him a choice lot of the beautiful aqua-marines and topazes of Nertschinsk. M. Popoff had also a large cabinet of the insects of north-eastern Asia.

We had been detained for nearly a month at Troitzkozavsk, waiting for Lake Baikal, 180 miles distant, to become permanently frozen. It was generally the middle of January before the ice formed to a thickness sufficient to prevent its being broken up by the winds. On the 15th of January we learned by telegraph that sleighs had already crossed the lake, and after bidding good-by to our many hospitable friends we started for Irkutsk.

Thenceforth our journey was to be made by post, and to facilitate our progress M. Pfaffius kindly furnished us with what were called crown passports, which were intended only for officials traveling on Government business. These papers insured the immediate furnishing of relays and horses, while travelers who had only the ordinary passport were subjected to constant delays and extortions. M. Garnier, having business in Irkutsk, decided to accompany us, taking with him his Cossack cook. This region partakes to a great extent of the dryness of the atmosphere of Central Asia. The mountains lying to the north condense the moisture brought from the Arctic Ocean, leaving but little to be precipitated on the plateau and its northern declivity, and this in the intense cold falls in dry, flat crystals to a depth of only an inch or two. Consequently the first part of our journey had to be made in wheeled vehicles. When we were ready to start we

found the Cossack too drunk to keep his seat upon the baggage, and after he had rolled out once or twice, at the risk of being left on the road, we hit upon the expedient of tying him in his place.

The first stage of our journey brought us to the broad Selenga River, and on its frozen surface we traveled down the valley on sleighs. There is considerable cultivation in this valley, notwithstanding that the mean annual temperature is the freezing point of water. After two days and nights we looked to see the sun rise over the glistening ice of Lake Baikal. This great inland sea, more than four hundred miles long, is inclosed between mountain walls. Its opposite shore of cliffs, about thirty miles distant, seemed but an hour's walk, so deceptive was the clear atmosphere of this country. For several miles from the shore the surface was very rough. The ice of previous freezings, driven landward by the wind after each breaking up, was piled in rugged masses of white and transparent green, while beyond this shore belt, which looked like the tumultuous waves of an angry sea, extended a clear expanse of fresh, dark ice, out of which the cliffs of the opposite shore appeared to rise, their base and the white, rough border hidden by the convexity of the earth.

In the winter of 1861-62 this country was visited by a violent earthquake. A flat alluvial tract on the shore of Lake Baikal, near the mouth of the Selenga, was submerged, drowning the herds and people, and converting the former space of land into a bay of the lake.

After traveling a few miles along the brow of the bluff, we came to the post-house at Posoloskoi Monasturi, an ancient turreted building, erected in memory of an officer who was murdered by the Buriats about the middle of the seventeenth century.

The journey across the lake was the most exciting stage

of our trip. At first we bounded at a rapid rate over the rough border, between great blocks of ice, whose transparent bluish-green gave them the appearance of aqua-marine. We came at last upon the smooth ice—a dark, glassy surface stretching away as far as the eye could reach. Over this the horses bounded at a terrific pace. We seemed to be gliding in some mysterious manner along the surface of a calm sea, and the strangeness of our situation was occasionally heightened by loud reports caused by cracks that are repeatedly forming in intervals in cold weather, cleaving the icy surface for many miles. We were several times obliged to make detours to avoid these, where they were either too wide to jump with the sleigh, or where one side had been raised two or three feet higher than the other. Upon the ice in the middle of the lake an enterprising Russian had established a restaurant, where we took a welcome dinner.

When we reached the opposite side we were detained for some time waiting for the moon to rise, as our road lay for several miles further along the shore of the lake, where traveling in the dark was not thought safe. By the time the moon rose a number of other travelers had collected at the station, and as we left terra firma we formed a procession of five or six sleighs. The one occupied by St. John and myself, being the lightest, was allowed the rather doubtful honor of taking the lead, to test the strength of the surface. The route was by no means free from danger. The water of the lake having sunk, the ice in many places remained without other support than its own stiffness; and the hollow sound which reverberated beneath us, as we passed over these places, gave a timely warning to those behind us but was by no means reassuring to us. Two or three times the covering broke and horses and sleigh went through, fortunately, however, in each case bringing up on a second sheet of ice, which had formed

two or three feet beneath. These accidents sometimes happened in places where an under sheet has not had time to form. Few years passed without some lives being lost in crossing.

Daybreak found us traveling over the inhabited plains on the eastern side of the Angara River. Here, for the first time, we saw one of the most beautiful phenomena in Nature—a Siberian mist. A thick haze filled the atmosphere, and disappeared with almost the first rays of the rising sun. As it lifted like a dissolving veil, a feathery coating of ice crystals covered every object far and near; the surface of the endless fields of snow, our sleigh, the backs of our horses, the clothing of the driver, and the forest from the roots of the trees to the tips of the smallest twigs—everything that the eye fell upon was covered with a downy coating of these flat crystals, reflecting everywhere the rays of the sun, like a universal incrustation of diamonds. The telegraph wires over our heads had the appearance of jeweled cords an inch thick. No description can convey an idea of the enchanting appearance of this scene, which was visible but a few minutes, and then vanished with almost magic suddenness before the first warmth of the sun. This phenomenon is apparently caused by the evaporation of the overflowing water of the Angara into an atmosphere of a far lower temperature.

Before noon we came in sight of Irkutsk, the capital of eastern Siberia. Here, also, we found that a letter written from Peking by General Vlangali had insured us a good reception. We were taken by our new friends to a large and elegantly furnished house, which we were told was entirely at our service. We learned later that it had been the house of a certain countess who was the mistress of the previous Governor-General. This courteous chief of police, after accompanying us to our quarters, kindly placed his valet at our disposal during our stay. On the day of our

arrival we paid our respects to General Salaschnikoff, the acting Governor-General, and afterward to his wife.

My share of the cost of the journey from Peking to Irkutsk was 718.55 roubles, about $360.

I don't know how many people there were in Irkutsk, but it was a tolerably large city. The inhabitants were largely descendants from both criminal and political exiles. Among the latter were many of the best families of Russia, or their descendants, exiled for plotting to make Alexander Emperor instead of Nicholas.

We immediately formed a circle of acquaintances which made our sojourn extremely pleasant, besides giving us the means of judging somewhat of the social condition of a country which was supposed to be the frozen tomb of all exiles.

The position of the Governor-General was that of a Viceroy. As such he entertained with a liberal hospitality. The dining room of his palace was a great hall, and those who were admitted to his circle were welcome to come to the table without further invitation. During my stay I formed at times one of the thirty or more guests at the long table, and, as my neighbors could generally speak German or French, I gained from them much information.

The men I met here were chiefly army officers. In other circles I came in contact with all classes of political exiles, some of them nihilists, though I believe that term had not yet been invented. It was, however, from Prince Krapotkin, himself an exile, a man with ideal conceptions of social progress, that I gained the most pleasure and the most information on conditions in Siberia.

At Irkutsk our party was compelled to break up. Mr. Walsh, having to continue his negotiations in St. Petersburg, left us about a week after our arrival, and made the journey with an officer who was traveling as courier. A few days later Mr. St. John left in company with our friend, Major

Muravieff, who also traveled in the same capacity. Not being pressed for time, and wishing to stop at several points on the route, I remained behind, prolonging my stay in Irkutsk to nearly three weeks.

In the sixteenth century the family of Stroganof, who held from the Czar Ivan, the Terrible, a large tract on both sides of the Ural Mountains, called in the aid of the robber Yermak who, with his Cossacks, in eight years brought the whole Khanate of Siberia under the rule of the Czar. Cities were founded all the way from the Urals to the Pacific. Hunting, fishing, and trade in the valuable furs long formed the basis of Siberian industry and wealth.

The political agitators of Russia, and of Poland, have long supplied Siberia with a superior element of involuntary population, and the refined society which the traveler meets with in the cities owes its existence in great part to this source. These exiles were often voluntarily accompanied by their wives and families, thus bringing with them the social cultivation of the highest circles in Russia. Among these were, as already said, members of many of the most intellectual families of the Empire, who were exiled for connection with the revolution at the accession of Nicholas I. Instances of this devotion on the part of Polish women are of such common occurrence as scarcely to invite notice. During my stay at Irkutsk, when the Polish rebellion was furnishing exiles by tens of thousands, the wives and families of the wealthier prisoners frequently arrived, ready to sign papers by which they condemned themselves to undergo the same life and hardships and complete isolation from the rest of the world, indeed to submit themselves and their children to the same fate as their husbands and fathers, so long as these should live. The policy of exiling was abandoned in 1900.

The descendants of these exiles became firmly attached to

the country. When they could afford it they traveled through Europe, many of them going several times. Whenever I questioned Siberian ladies as to their attachment to the country, they invariably replied that, although they were very fond of making long journeys to Paris and Italy, they would never choose for their home any other country than Siberia. And the attachment was even stronger with the peasant, who, next to his God and the Emperor, reverenced the soil of his birthplace.

In Irkutsk masquerades, the theater, dinners, and balls, at private houses and at the clubrooms, left little to wish for in the way of social enjoyment.

I was struck with one peculiarity of Siberian society, which, however, did not extend below the merchant class. This was the apparently greater amount of care bestowed upon the education of women. They seemed to be generally better trained than the men, not merely in music but in foreign languages and the general branches of education.

The remoteness of Siberia from the markets of the world, at the time of my visit, set a limit to foreign trade in all but special articles, such as furs and Chinese tea. Mines of gold were actively worked. The opening of the country by the Trans-Siberian railway is filling this vast region with a selected population. A branch line runs through Manchuria to the Yellow Sea, and others are proposed running south to Kalgan, and to Central Asia. Thus Siberia will have outlets for the potential products of varied industries, to the markets of China and of the peripheral zone of the Pacific on the one hand and of Central Asia and Europe on the other. The great possibilities of its agricultural and forest areas and of its wealth in gold and copper deposits and of coal and iron ore foretell a brilliant future for Siberia.

It should seem that, in time, the Ural Mountains may come to divide the traditions of the past from the aspirations of

the future, and form not a racial but a cultural and political barrier between these two great parts of the Empire.

The two great evils of the country, which run through all classes, are gambling and drinking to excess. I know of no nation in which drunkenness assumed such frightful proportions as in this eastern part of the Russian Empire. During my stay in Irkutsk a gentleman told me, in illustration of this fact, that in one week, immediately after a reduction of the Government tax on spirits, thirty-five men and women in a village of 500 souls had killed themselves with drinking. Another instance, related to me by a Siberian lady, was that one of her female servants, having obtained leave of absence under pretence of visiting her dying mother, had gone directly to a drinking shop, where she lay four days in an incessant state of drunkenness. But another most absurd example was one which came under my own observation. The reader will remember that on leaving Kiachta we were obliged to tie the Cossack fast in the carriage. M. Garnier, having decided to return to Troitzkozavsk, had taken the precaution to send this man the day before with a note to the chief of police, requesting that the bearer might be put in prison until he should be sent for. When everything was ready for the journey, and M. Garnier had taken his place in the sleigh, the Cossack arrived under special charge of a policeman, and perfectly sober. My friend was delighted at the success of his manœuver, but having forgotten some small article of baggage, he sent the man into his room for it. Myself entering the house about a minute afterward, found the rascal just putting down empty a decanter which a few minutes before had been nearly full of our choicest brandy. The fellow had made the best of his opportunity, and before the sleigh started was, of course, as drunk as when we left Kiachta. I was told that in Kamtchatka the inhabitants are in the habit of using a fungus in their liquor, which not only

increases the intoxicating effect, but has also the advantage that as soon as a man begins to get sober, a glass of pure water will make him as drunk as before. It is said that in delirium tremens the Russian, instead of being tormented with visions of snakes and other animals, sees only little devils of the conventional type. "He has seen the little devils," is a common phrase in explaining that a man is in the last stages of drunkenness. Let us hope that the recent decree of prohibition may be successfully enforced.

Gambling seemed to be even more widely spread, since it pervaded not only all classes but both sexes. The Siberian ladies were great adepts at cards, a fact which my companions and I learned to our cost on the very threshold of the country. After dinner, soon after our arrival at Kiachta, we, each of us, in the course of an evening, lost to our hostess at whist nearly the whole sum which, for the purpose of avoiding the appearance of singularity, we had calculated on devoting to play. During the whole game the lady kept up a constant fire of sparkling conversation, but was such an excellent player that, while our attention was constantly diverted, she kept the run of the cards perfectly, and had at the close every detail in her memory.

It was hardly thought proper for ladies before marriage to play for money, but they certainly made up for the privation immediately after. Many of them began in the morning to make their calls, and drove from house to house till they happened at some friend's to find a gathering large enough to form a party at their favorite game of hazard, *stut-kolka*. One lady told me that, although she was very fond of cards, she played them quite as much in self-defense as for the pleasure, "because," she added, "while my husband is losing at the club I am just as likely to be winning from his opponent's wife."

In a country where gambling was so universal, one expected

to find every foreign and native device that had been invented for games of chance, but I was told of one for which I think none will dispute the honor of invention with the Siberians. In the prisons, where gaming was strictly forbidden, the inmates resorted to the following curious means of indulging in their favorite propensity. Each man carried in a corked quill a select specimen of an insect which he was never at a loss to find without going further than his own clothing. The game consisted in putting these animals in the center of a circle chalked on the table, and betting as to which would first reach the circumference. Each man knew his own racer, which he had trained with care, feeding it in certainly the most affectionate manner by holding the open end of the quill against his wrist or temple.

During my journey I incurred a lasting debt to the Siberians for their hospitality. I could not help thinking that this was extended to me quite as much in my character of an American as individually. It was pleasant to meet everywhere an expression of the most cordial feeling toward the United States, and I was often surprised to hear, in this distant part of Asia, a very just appreciation of the causes and probable results of the war which was then going on at home. Everywhere there existed the strongest sympathy for the North, and a general good feeling had become widely spread by the accounts of the cordial reception which the Russian fleet had met with in the United States. The position occupied by the slavery question in our struggle had something to do in influencing the feelings of a nation in which the emancipation of serfs had recently become an accomplished fact. Somewhat was due also to the points of resemblance between the Civil War in America and the one then being crushed in Poland.

CHAPTER XXXVIII

SIBERIA (*Continued*)

My departure from Irkutsk was delayed several days, owing to the difficulty of obtaining a comfortable *kibitka,* or traveling sleigh. This vehicle was of all sizes, entirely open, or with a hood behind, or completely covered; mine had a hood behind and the front part was decked over. It had only a single pair of long runners, and, to prevent upsetting, was provided with a guard frame, which, starting from the body of the sleigh in front, spread out some twelve or eighteen inches from the sides at the back end. As soon as the vehicle tipped, this framework touched the ground.

Every part of the *kibitka* was thoroughly braced, in a manner to secure the greatest possible strength as well as lightness, without too great rigidity—precautions which were absolutely necessary, since these sleighs were expected, before wearing out, to make several journeys of from two to four thousand miles, over roads that are anything but smooth, at the rate of ten and sometimes even fourteen miles per hour.

Expecting to travel alone, I waited until I found a very light sleigh, which was not much more than wide enough for one person, for which I paid sixty roubles—$30.

The postal service in Russia, considering the immense network of roads it covered on both continents, was, in many respects, the most perfect in the world. In some parts of the Empire it was given under contract to private enterprise, but through Siberia it remained in the hands of the Government. Relay stations were established at distances of from

eight to fifteen miles, under the charge of postmasters, whose duty it was to provide horses and attend to the mails.

There were three ways of traveling—by buying a ticket as passenger with the mail conveyance, by purchasing a common order for horses, or, finally (if traveling on Government business), by having a Government order, which cannot be bought. In the first of these methods, which is very cheap, costing only one and one-half kopeks (cents) per verst (mile), the traveler was obliged to go directly through, and was, moreover, likely to be associated with not over-pleasant company. In the second, with the common permit, he was exposed to the extortion of postmasters, and to delays which, unless he satisfied the greed of these officials, might lengthen his journey by weeks.

The much coveted Government order admitted of no delay, and required the furnishing of horses in preference to everything but couriers and the Imperial mail. The traveler was allowed as many horses as he was willing to pay for, at the rate of one and one-half kopeks each per verst (about one and one-half cents per mile), east of Tiumen, and west of that point at three kopeks each, about three cents per mile. Through the kindness of the Governor-General of eastern Siberia I obtained a Government order, which relieved me from anxiety.

Before taking final leave of Irkutsk, I expressed my deep sense of obligation to the Governor-General of eastern Siberia, to the chief of police of Irkutsk, and to Count Paul Anosoff for their private hospitality, no less than for their official assistance, without which my journey would hardly have been possible, and also to Colonel Reingard and Mr. André Razguildieff.

On the evening of the 6th of February, 1865 (new style), I left Irkutsk, and started on my lonely journey westward.

Following the Russian custom, I had my baggage spread out over the bottom of the sleigh and covered with a quantity of straw, and placing over this a Japanese mattress and a number of fur robes, I secured a bed which was both soft and thick enough to deaden the shocks of rapid traveling over a rough road. A number of large pillows were placed at the back, to raise and support the shoulders and head; for the Russians have discovered that a half-reclining posture is the most convenient in traveling, since every muscle is at rest, and yet the elevation of the head permits a view of the surrounding scenery.

Having learned by our rough experience in Tartary how necessary it is to clothe one's self in the manner which the natives of the country have found to be the best, I had taken every Russian precaution against the cold, and had prepared to incase myself in an outfit which I can recommend to travelers as a sure protection in the most extreme climate. Over a pair of thick and loose woolen trousers and a woolen shirt I put on the close-fitting robe worn by the peasants, reaching from the neck nearly to the ankles, and made of sheepskin, with the wool inside, and over this a loose robe of the fur of the Arctic fox, with the hair also on the inner side. My feet were incased in very loose boots of felt, reaching nearly to the knee. A Chinese skullcap of felt, with fur lappets, protected the head and ears, while a long, knitted muffler, covering the whole face below the eyes, after being crossed behind the neck and tied under the chin, protected nose, throat, and lungs. Before getting into the sleigh the traveler puts on over all his other garments a wrapper of reindeer skin, with the hair outside to break the force of the wind, and furnished with loose sleeves and a collar, which when raised envelops the head and face. Lying down and putting his feet and legs in a large wolfskin bag and stretching them out under the deck, he pulls over him two big fur sleigh-

robes which reach nearly to the chin. He is now ready to defy the greatest severities of even a Siberian winter.

The cold, which had been increasing every day, seemed on the first night out of Irkutsk to have reached a more intense degree than I had yet experienced, and before midnight my hands and feet were nearly frozen. At the first station, by the advice of a traveler, I put dry hay between the soles of my feet and the boots, and was fortunate enough to find a woman with an ample muff, which I bought for a few roubles and found to be preferable to any gloves. After this, during the whole journey, I never for a minute suffered from cold. The nose is always the most difficult part of the body to protect; but by pulling the comforter about an inch forward, and holding it there till it stiffens with the frozen breath, the whole face is kept warm by the heat of the breath.

Finding myself thoroughly defended against the severity of the weather, I now began to enjoy the wonderful night-scene which surrounded me. Three bounding horses carried the sleigh at almost railway speed, dashing in rapid succession through groves of trees, through fields and forests. A deep mantle of snow, rounded and softened the surface of hills and valleys of an uneven country, illuminating the whole scene with the tender light reflected from its pure surface. Overhead the stars shone with flashing luster through an atmosphere whose purity is equaled only on the higher and dryer parts of the earth. After a time I allowed myself to yield to the call for sleep.

On awakening I was not a little startled at being unable to open my eyes. I found them perfectly sensible, but the lashes were frozen together and to the edge of the comforter. After fruitless attempts to force them apart, I enveloped my head in the collar of the outer cloak till the breath had thawed them out. At the station we reached before sunrise I got out for breakfast. Having been warned of the impossibility

of getting any decent food outside of two or three large cities, I had taken an abundant supply of tea, coffee, and sugar. A lady sent me dinners for many days in the shape of sixty plates of soup, each one frozen into a separate cake with a ptarmigan in the middle, and from another lady I had received enough bread to last for several days. Almost every Russian house owns a samovar, or urn, for boiling water, which is heated by charcoal in a tube extending from top to bottom. This was the only thing, excepting plates and glasses and other rough tableware, that the traveler could count upon in Siberia. The samovar was heated, and in a few minutes from the time of my arrival I had made a sufficient breakfast on six or seven large glasses of tea and a couple of slices of dry bread, and I adhered to this bill-of-fare during the rest of the journey. There is nothing so refreshing and so sustaining in a cold climate as good black tea. Its stimulating effect is both gentler and far more lasting than that of spirits. On the way from Kiachta to Irkutsk we had stopped to make tea at every station, and the temptation was very strong for me to continue the habit; but an easy calculation showed that a delay of half an hour at every relay would lengthen my journey by more than a week, and I resolved to confine myself to three stoppages daily.

The spirit thermometer outside of the station marked —45° C., or over 70° below zero of Fahrenheit, while within doors the heat could not have been less than +85° or 90° F., involving a plunge from extreme to extreme which is not only uncomfortable but dangerous. In entering these station houses, it is necessary to leave in the cold vestibule the outer reindeer skin robe, as the low temperature of the fur would cause it to be drenched with the condensing vapors of the hot rooms to an extent that would render it as stiff as a board on reëxposing it to the outside air. I was now entirely among strangers. My only companions, the drivers, changed with their horses

at every relay; and understanding, as I did, nothing of the language, the long journey loomed up before me like an impracticable task, an endless succession of strange postmasters.

During the morning of the second day, just after I had entered the yard of a station, the postmaster appeared, and to my delight addressed me in German.

"You are going through to Moscow?" he asked.

"Yes," I replied.

"Could you take a fellow traveler?"

"I have every wish to be accommodating; still it depends upon who the traveler may be, as you see my *kibitka* is meant for only one passenger."

"Oh! I will guarantee her sociability."

"Her? The traveler is a woman, then!"

"Yes, sir," replied the postmaster, "a young lady who is traveling westward on very pressing business, but her *kibitka* has broken down and I am unable to give her another. The only alternative she has, if you will allow her an alternative, is between traveling in your sleigh or in that of a Russian priest who has just arrived."

"How is it possible," I asked, with astonishment, "that any lady could hesitate in choosing between a perfectly strange foreigner and a holy man?"

The postmaster disappeared to gain some further light on this strange situation.

Now, in making a resolution to take the first respectable traveler I could find, I had made an express reservation against lady passengers; but here was a prospect of being wedged into a narrow sleigh, made to carry one passenger, I did not know for how many days and nights, with a woman of whose appearance or proportions I had not the slightest idea. It was certainly an alarming prospect for a bachelor. But before I had time for further meditation the postmaster reap-

peared. There was no getting out of it; and with the best grace possible, in my ignorance of her size, I sent the landlord to assure the lady that I should be delighted to have her share my sleigh. After her baggage had been carefully stowed with mine in the bottom of the *kibitka,* and her own bedding distributed over mine, my fellow passenger appeared, but wrapped in such quantities of furs and so closely veiled that it was impossible to judge of either her age or appearance; but just before getting into the sleigh, she raised her veil to salute me, and perhaps also to take a good look at her traveling companion, and in doing so exhibited a young and attractive face. I congratulated myself upon not having adhered to a resolution which would have deprived me of so charming a companion. After traveling for half a mile or more, I broke the silence by some commonplace remark in German. My companion shook her head. "She speaks French," I thought, "all Russian ladies speak French;" so I repeated what I had said in that language. Again she shook her head. "Perhaps she understands Italian; the Russian ladies are great musicians, and generally study Italian." So I reiterated my attempt in Tuscan, and then in English, but each time there came that ominous shake of the head. I was now in despair; the idea of traveling for days, or perhaps weeks, with a companion, but without having a single expression in common was too aggravating to be borne. I knew one Russian word—that for horse. Leaning forward I pointed to the animals and called out *"loshada! loshada!"* The effect was electric. She saw that it was the only word between us, and the whole ridiculousness of our situation presented itself to her mind as it had to mine. After laughing she spoke for some time in Russian, and the ice which had threatened to separate us was at last broken.

I think it was during this day, or the following one, that our road lay along the brow of one of the lofty terraces

which flank the Altai Mountains on the north. The country on every side was covered with a dense forest. On our right hand it was depressed far below us, and the eye ranged over the unbroken surface of a wilderness, which extended to the horizon, and as I knew continued like a boundless ocean ever further and further northward till it reached the limit of trees around the pole. These northern solitudes still inspire one with something of the mysterious fascination which we see in the ideas of the ancients concerning the Hyperboreans, and the Arimasps, who fought with the griffons for golden sands in this land of perpetual night. From where we were there was but a single transition between us and the pole—one vast and gloomy forest, giving way at its northern limit to perpetual ice. Although the forest disappeared under a distant horizon, I could trace in my mind its changes toward the north; birches and maples becoming ever fewer, their places supplied by lofty pines, and these dwindling in stature and at last giving way altogether to the more hardy dwarf larches of the Arctic swamps, and these in turn yielding to the polar tundras which cover the frozen tomb of the mammoth.

During the day we came to a long and steep descent from the terrace. Already, before we reached the brow, the driver whipped up his horses, and in going down the hill kept them on the run. The road was as smooth as glass, and our speed terrific; but as soon as the traces began to slacken, or the sleigh to swerve in the slightest, the driver again used the whip. This is unavoidable on hills, where the smooth surface is frozen so hard that the runners take no hold upon the snow, and is the only way of avoiding either being upset or going downhill backward, dragging the horses. I must confess that this coasting experience on the first long declivity fairly made my hair stand on end. When the sleigh struck in the deep cross-trough (with which every long descent ends

in Siberia) it bounded two or three feet into the air, leaving my companion, myself, and all our baggage mixed up in an almost inextricable mass.

For many days the journey was devoid of remarkable incidents. Traveling uninterruptedly day and night, and leaving the sleigh only long enough to take our three slight meals, I kept few notes, and lost altogether the run of dates. The general appearance of the country, its succession of great forests, of hills and plains, of the valleys of great rivers where cultivated fields lay hidden under the white cloak of winter, its countless villages buried in snow up to the roofs of the houses, with excavated streets—all these remain impressed upon my memory rather like a vision of an enchanted land than as the real scenery upon an actual journey. I remember one or two terrible snowstorms which fell with blinding force and with a fierce wind.

The moon waxed full and waned, and still my companion occupied her place in my sleigh. When she would leave I had as yet no idea. I was not anxious that it should be soon. In the meantime I made progress in Russian. Every day added a few words or phrases to my vocabulary, until finally we were able to bring a little language to the aid of conversation, which was at first kept up only by signs. It was sometimes not easy to make out whether my companion was asleep or awake, especially in the early morning, nor was it an easy task to make preparations on my own part for finding this out. In the first place, there was the usual necessity of thawing out one's eyelashes. It was only after this, and pulling down the great collar of the outer robe, and rolling over on the left side, that I caught sight of my companion, or rather a mountain of shapeless furs towering beside and above me, and issuing from the top a small spiral column of vapor like that which betrays the wintering place of a bear. How was one to know whether sleep or wakefulness existed under these

motionless robes? The mother of invention taught me a ready expedient. Lighting a cigarette, I puffed vigorously till I felt sure that every fold and crack was penetrated by the aroma. It was a sure test, for my companion, like most Russian ladies, was passionately fond of smoking, and never could resist the temptation. If she was awake a gentle movement was soon perceptible, ending after a while in the appearance of a small hand with a cigarette stretched out to be lighted. In this way the time passed smoothly enough, which is more than I can say of the road. The frequent cross-troughs sent us bounding every now and then into the air, to come down with a shock that entirely destroyed the equilibrium of our arrangements, which required very delicate adjustment in a sleigh not more than three feet and a half wide at the back, and two in front.

But it is now time that I should relieve my companion from the rather embarrassing position which she must hold in the reader's mind, when considered simply as the coöccupant of a stranger's sleigh during so long a journey. Her strange history, which I learned in part from her, I will give as I afterward heard it more fully at St. Petersburg. This lady was the daughter of a noble family of Warsaw, of which she and a brother were the only children. The latter had become an officer in the Polish army in the rebellion of 1863, and had been made prisoner under circumstances which caused him to be convicted and sentenced to life-long labor in the frozen mines of eastern Siberia. This punishment, which seemed to the aged parents and sister more awful than death, was rendered more painful by the fact that no communication could be held with the exile, who might die under the fatigues of the long and terrible journey across Asia. In order to give comfort and companionship to her brother during his journey, and to bring back news of his safe arrival, this girl, scarcely eighteen years old, formed the

resolution to go with him, a point which she carried against all opposition. With a large number of political exiles and convicts of every class this young woman, who had hitherto seen nothing but the comforts of home and the gaieties of a brilliant capital, made the long and terrible journey, tramping for months through the snows of Siberia, exposed daily and nightly to the hardships and filth of the prison stations, and surrounded by scenes of suffering. She saw her brother arrive safely at Irkutsk where he was interned with others for several weeks before being distributed. Then, without waiting to recover from the fatigues she had gone through, she started immediately on the long journey to Omsk on some business connected with the exile's condition, and it was on this trip that the breaking of her sleigh threw her into my company. This devotion, and the circumstances by which it was surrounded, cannot but recall to the reader the touching story of Elizabeth, whose life was in the same land, and whose journey was partly over the same road.

Wishing to rest for a few hours at Omsk, I drove to a hotel and ordered dinner. During the meal a soldier arrived and demanded my passport. To my horror I found that I had probably left it behind, at some station. In its stead I handed over the Government order for horses, and told the soldier that I was traveling from Peking to the United States on official business. With this information he departed. Before long he reappeared, stating that the chief of police had himself been in Peking, and would be happy to see me. Accompanying the policeman I proceeded through the city, and was brought into a large public building, and into a room which I instantly saw was a police court. About fifty men and women of the lowest class were standing in a row, while at a table there were seated several clerks, and an officer in the uniform of a colonel. After informing me that

this officer was the chief of police, my guide went up to him and whispered something in his ear. Very much to my surprise, the man who had invited me on the score of having been in Peking merely looked up, and after a long stare went on with the business in hand. Not having been asked to sit down, I walked to the nearest chair and seated myself, but was immediately forced by a Cossack to stand up. Being indignant at this treatment I went up to the chief of police, and found that he understood neither English, French, nor German. After failing in the use of signs and the little I knew of Russian, a clerk who spoke German came forward. I explained the loss of my passport, and demanded to know why I had been brought thither to be treated as a common criminal.

The official became furious, and ordered me under arrest. As the prison-keeper started to take me from the room, I shook him off, and turning to the clerk said: "Tell the chief of police that I am bearing despatches from the United States Minister at Peking to my Government at Washington, and that he will be held to account at St. Petersburg for every hour I am delayed." The old man after some hesitation interpreted my language. The chief of police answered that he did not believe it; that I was there without any passport, and had been traveling in company with a sister of an exile; in short, that he believed me to be a dangerous character. If I was carrying despatches why did I not show them. Taking from my pocket a large envelope addressed to the home Government, and bearing the seal of the legation, I handed it over to the official, who made a move to break the seals, but on second thought handed it back to me after merely examining the outside. I was now allowed to depart, though without any apology for the treatment I had received. This unpleasant episode was the only official annoyance that I underwent on the whole journey.

My companion having stopped at Omsk, I was now alone. The country from this point on, and, indeed, the whole region of the Obi River and its tributaries, was much more thickly peopled than eastern Siberia. We were continually passing through villages where the streets were cut out of the deep snow, which had drifted over the roofs of houses. These Russian villages consisted altogether of log houses, generally not more than one story high. As the heavy frosts threw the buildings out of position, the older ones were often so inclined to one side that it was no easy task to cross a room where the smooth and greasy floor was sometimes at an angle of from ten to fifteen degrees with the horizon. In the waiting room of the post-houses the walls were generally decorated with one or two coarse prints, either of a religious character or representing the exploits of Yermak. One corner always contained a picture of some saint, gilded in the Byzantine style. In the inscriptions under one picture of the twelve apostles, the artist had made a slight mistake by placing the two before the one, thus making it read "The 21 Apostles." A lamp always hung before these shrines, and no Russian ever entered the room without immediately facing them and making three times the sign of the cross.

It would be difficult to find a country in which the people are more superstitious than in Russia. No Russian maiden would be left alone with her lover in a room where there was a picture of a saint. To meet a priest on leaving a house was an omen of evil, which could be charmed away only by throwing a pin at him if you were a woman, or by spitting on his beard if you were a man. The aversion, which we find in other countries, to beginning any enterprise on Friday, and to making the thirteenth person at table, here assumes an importance unknown elsewhere; for instance, a Russian will instantly leave a room where three lights happen to be

on one table, because these recalled Christ and the two thieves.

At Tiumen I remained over one day. Unfortunately the great fair, which is held here every year in January, was now finished, and the visitors whom I had hoped to see from many parts of Asia had departed. The only consolation I obtained for this loss was a dish of sterlet, a species of sturgeon peculiar to the rivers of western Siberia and to the tributaries of the Caspian. It is certainly the most delicious of all fishes, and is perhaps the greatest delicacy in the markets of St. Petersburg.

Not long after leaving Tiumen the road entered upon the gentle ascent of the eastern flank of the Ural Mountains. This range is so low and its approach, especially from the east, so easy, that I reached Ekaterinburg without appreciating the fact that I was near the summit of one of the most celebrated mountain ranges of the world.

At Ekaterinburg I presented letters of introduction to Colonel Lenartzen, the director of the mint. A cordial reception induced me to remain for several days, in order to make some interesting excursions in the neighborhood. The first day was passed in visiting the mint, where only copper was coined, and afterward in the stone-cutting establishments belonging to Government and to private individuals. In the Imperial establishment were made the greater part of those vases, tables, and columns of lapis-lazuli, malachite, jaspar, aventurine quartz, and porphyry which adorn the palaces of Europe. In the private workshops smaller objects of ornament were made from the many beautiful minerals of Asia. The chief of these were malachite, rhodonite, lapis-lazuli, aquamarine, topaz, and quartz in all its forms—agate, chalcedony, jasper, bloodstone, amethyst, and rock-crystal, both clear and smoky.

On the second day I drove, with Colonel Lenartzen,

out to the nearest gold-washings,* about nine versts from Ekaterinburg.

On the third day of my stay I started on an excursion to the iron and copper works of Nijni Tagilsk, north of Ekaterinburg, on the eastern flank of the Ural Mountains. Here were the extensive mines and smelting works belonging to the Demidoff family.

Through the courtesy of Mr. Nietki I was shown through the iron works, and had an opportunity of seeing the process of manufacture of the celebrated Russian sheet iron, which then had, I believe, never been described.†

On leaving Ekaterinburg I took in as fellow passenger a

* The placers were in the small swampy depressions occupied by rivulets. Here, under a covering of about ten feet of sand capped with peat, there lay a bed about two feet thick of auriferous sand, which was clayey, and contained large quantities of fragments of chloritic and greenstone schists, quartz, diorite, etc. The yield for the day was about one zolotnik (36 grains) of gold per 100 puds (3,600 lbs.) of the pay-dirt.

At the placers of Biriasowsk, near Ekaterinburg, the average yield was 23 dolias (16 grains) per 100 puds (3,600 lbs.), an amount which paid when the auriferous deposit was not more than three feet and a half below the surface.

† Charcoal iron after being puddled was rolled into sheets thirty inches long, five inches wide, and one-half inch thick. These, after being heated in a furnace with a very reducing flame, were quickly brushed, gone over with wire brushes to remove any foreign substance that might have fallen upon them, and were then passed between rolls, the upper one of which was unconnected with the lower, rolling only by friction. By the time the sheet was cooled it was about fifteen inches wide. Packages of three sheets were now laid in the furnace, and then rolled again, after the upper sheet had been brushed, and charcoal powder thrown between them to prevent adhesion. If thin iron was desired, the sheets were subjected to a third heating, in packages of four or six, and re-rolled, after which they were trimmed to the proper dimensions. They were then sent to the forge, where they were three times heated and hammered, in packages of from sixty to eighty. After the first hammering each sheet was swabbed with a wet mop to harden the surface. It was said that tar was sometimes used for this purpose.

Two packages, one hot and one cold, were then mixed in alternate sheets, to produce the greenish color in cooling, and the mixed package was then passed backward and forward under a large hammer, and after this was again mixed and re-hammered.

The superiority of the Russian product was due in great part to the cleanliness of the work, and to the carefulness and skill of the workmen. Every sheet that was at all spotted was thrown into the second or third class, and the difference in value between these and the first quality was deducted from the pay of the workmen.

Russian who was going to Nijni Novgorod. Almost imperceptibly we reached the summit of the Ural Mountains, a fact which I should not have known had not my companion called attention to a small monument which marked the boundary between Asia and Europe. The descent on the western side of the range is much more perceptible than that toward Asia, and presents a great number of fine views over the valleys of the small streams which flow toward the Volga.

My companion was a true Russian. Every time that we passed a church or a cross, even though in the midst of conversation, he would suddenly stop and repeat a short prayer, while he crossed himself three times. The fear of missing an opportunity to perform this ceremony kept him constantly employed in spying out the church towers and steeples of towns we were passing through, or of villages lying off the road.

Every time we met a group of exiles he would stop the driver and distribute here and there a few kopeks. I did not learn whether this was his habit through life. If it was, he must often have been like the Englishman—was it Dr. Johnson?—who, falling into the habit of touching every post he passed, often imagined that he missed one, and was then sure to be an unhappy man till he had returned and touched it.

My Russian was an engineer in the telegraph service. He was sure that through the building of railroads the climate of Russia had been much changed, due, he thought, to electrical disturbance. This reminded me of a strangely similar fear of the Chinese that railroads would interfere with the operation of *fung-shui*.

During the whole journey from Irkutsk I had passed at intervals groups of exiles, but near the boundary of Siberia they were both more frequent and numerous. Made up of representatives of every class of society, from prince to peasant, these unhappy people dragged slowly forward on the

long journey to the land of their imprisonment. A number of them were gathered around the monument which marks the line between Asia and Europe. The joy which I felt on seeing this sign of a rapid approach to familiar places and home was almost taken away by the thought of the widely-different feelings with which these exiles must regard what was to them an emblem of separation from the world and all that is dear.

We were now traversing a country in which the population grew denser, and the cities and towns more frequent, with every day's journey westward till we reached Kazan, in the valley of the Volga. I would willingly have stayed some time in this ancient capital of the Mongol Empire in the West. Its inhabitants were for the most part descendants of the Mohammedan subjects of the Khans, who still adhered strictly to their ancient faith, and ranked as the best elements of the population.

A journey of less than two days from Kazan brought me to Nijni Novgorod, then the eastern terminus of the Russian railroads.

Exclusive of stoppages at Ekaterinburg and Tiumen, I had made the journey from Irkutsk to this point in twenty-two days and a half; or, excluding the delays in changing horses and eating, I had traveled 3,112 miles in 352 hours, being an average of 8.8 miles per hour. The same journey was often made by officers traveling as couriers in fifteen days, through to Moscow before the railroad was built in Nijni Novgorod.

I had little time to make arrangements to take the train, and was without the money to buy a ticket to St. Petersburg. I had a mattress of raw silk in a tick of heavy silk. Also three great robes, one of Arctic fox and two superb ones of Siberian bear. I had besides, a large ulster of racoon fur, and another of the royal reindeer; and I had my sleigh. These things had cost several hundred dollars. The local

dealers were robbers, and I was lucky to get enough money to pay my way to the capital. The mattress had been made of raw silk on the advice of Mr. A. A. Vantine, who had been a fellow traveler on the voyage from San Francisco. Many years later he told me that the raw silk in that mattress would sell, if I had it still, for $800.

When I entered the train I found Mr. Walsh's partner on the Russian-American Company negotiation, from whom I could have borrowed what money I needed, and have saved all my choice furs.

Mr. Phillippeus was an importer of tea from China. He told me that the "Caravan" tea was from the same district of central China and from the same quality of leaf as that sent by sea to Europe and America. The real difference was in the curing; the tea going by caravan overland in winter was "fired" only once, while for that going by ship through the tropics three firings were necessary, and these diminished the flavor.

I saw a great many teams hauling freight alongside of the railway, and was told that this kind of transportation was cheaper in winter than by rail.

After arriving at St. Petersburg I found at our Embassy the first letters I had had from home for six months. One among them told of the death of an aunt, my mother's sister, who lived with us and was dear to all of us. This news was all the more startling in that it confirmed a dream that had occurred to me one night on my way from Irkutsk to Nijni Novgorod. I had dreamed that I had reached my native village and had walked from the station. As I came up the driveway to the house I saw my father and mother standing on the veranda. Both of them were in tears, and evidently under the influence of strong grief. I noticed particularly that my aunt was not with them and I drew the inference that she must have died. Then I awoke.

When I read the letter I remembered the dream, and that it had impressed me so strongly that I had made a note of it on a piece of paper by writing the date and adding an inverted torch. Unfortunately I could not find the note to compare the dates, but I remembered that as near as I could make it out, at the time, the date coincided closely if not indeed exactly.

I have now found my mother's letter and can make the following statement.

My mother's letter said that my aunt had died on the 7th of February. I left Irkutsk in the evening of the 6th (new style); it was at that time morning in Owego. The death must have occurred between the time when in Siberia it was noon of the 7th and noon of the 8th.

In my dream it was in daylight that I saw my parents weeping, therefore a coincidence between the death and the dream would require that the dream occurred during the night of the 7th-8th—my second night out. I know that it happened in one of the early nights and I have a strong impression that it was in the second night.

On my arrival in St. Petersburg I found a letter from Walsh telling me that he had left instructions at a bank to accept my drafts on him for what I might need—an unexpected act of friendship, but in harmony with Walsh's generous nature.

My first visit was to the botanist Maximowitch, with whom I had had interesting excursions in Japan. He had now a most attractive wife, and was director of the Imperial Botanical Gardens. I never saw Maximowitch again, but fifty years later my wife and I were entertained in St. Petersburg by his daughter, Madame Lunin, at a dinner, with several eminent scientific men and their wives to meet us.

I made the acquaintance of Mr. Jeremiah Curtin—Secre-

tary of our legation—and had several instructive talks with him about Russia and Asia. Although still a young man, his knowledge of Russia, its people, language, and literature, as well as of other European languages, and his personality promised for him a diplomatic career which was denied by our political system of selection.

On the train from St. Petersburg to Paris my neighbor was a Baron de Frantche—I think this was his name. He was going to see the heir to the Russian throne, who was then dying in Nice. This acquaintance we continued till he left Paris. We stayed for a night in Berlin at the Hotel de Rome; and in the morning I recognized my room as the one I had slept in when, five years before, I left Freiberg, in starting on my return to America and my journey around the world.

Before de Frantche left for Nice he introduced me to two Russian ladies, Princesses Pantchoulidzeff, of the House of Demidoff. They had passed middle age. I went often to take tea with them, and to hear the violin played by an eminent Russian violinist who was with them. These ladies were building a castle, on the Gmundenersee, in upper Austria, and were buying, quite recklessly as it seemed to me, pictures and decorations, all of which, in spite of my avowed inexperience, I had to pass upon. The dear old ladies made me promise that when I married I would bring my bride for a long visit to their castle.

I went to stay at a pension at No. 6 Rue Castiglione where Madame de Pailhez lived. Five added years had not changed my old friend. We played whist or went to the theater every evening.

I was again out of money and without a letter of credit. My trunks were full of things from China and Japan, so I invited to my room a jeweler from the Rue de la Paix, and sadly spread my treasures before him. He bought a superb

fur of the sea otter, six snuff bottles hollowed out of crystals of aquamarine, engraved in low relief on the outside, and with stoppers of large rubies and sapphires—the only ones I had ever seen. He bought also a wonderfully carved box of rock-crystal. These things had cost me much, he paid many times their cost, but I would give treble what I got to have them again!

I had about a cupful of rough rubies and sapphires that I was keeping simply as mineral specimens of no jewel value. The jeweler had never seen these stones in the raw state. I told him of the big sapphire ball I had seen in Shanghai, and that if I had known how to judge of the commercial value of a stone I could have made a fortune in China because, while with us the value increases from carat to carat in a geometrical ratio, in China it increases only arithmetically.

"Well!" he said, "if you will give me those rough stones, which are probably of no other value than as minerals, I will make up a little collection of precious stones for your use in buying when you go again to the Orient. They will all be very small, but they will be absolutely perfect in quality."

I let him have the stones, but I reserved one that had fallen out of a cheap brooch I had picked up in central China. Like the others it showed some translucence. Later in New York I took it to Ball and Black to have it cut. The clerk said it was not a sapphire, and called in Mr. Monroe, the manager, who pronounced it a tourmaline. When later Mr. Monroe handed it to me, well cut, he said:

"You were right; the lapidary found it a sapphire, and it is the finest, though not the largest, we have ever had."

I had it set in an engagement ring. How many other stones equally good may the jeweler of the Rue de la Paix have found in my lot?

A friend in China asked me to select for him a rough

ruby. For the rough pebble he got for a few dollars he was offered, at home, several thousand.

The next evening I met Mr. Walsh at Mrs. Bigelow's reception at the Embassy. Again I had sold treasures a few hours too soon.

I felt deeply the thought of parting from my old friend, Madame Pailhez, knowing that I should probably never see her again, for she was then, I think, well over eighty. She was one of those rare old women who retain their faculties and sympathies and interests to the last. In her youth she had seen the revolution and the change from the old régime to the new. She had married one of Napoleon's officers, and, after the restoration of the monarchy, had accompanied her husband to Peru, where, I think, he fought in the war of liberation from Spain.

In more than one sense she contributed to my education. Her age and our close friendship allowed her almost unlimited freedom in our talks.

She was a Frenchwoman and a Parisian, and she was too kindly to be at all cynical in weighing the virtues and frailties of human nature. To her, in the life of Marguerite Gautier it was the strong light of the pathos that offset the shadow; in the relation of Beranger and Susette their affection outweighed the lack of a blessing by the church. So I may say that among the contributions she made to my education, not the least was the feeling that a broad charity for the weaknesses of human nature need not weaken the moral fiber.

When I reached London I went to rooms that had been engaged for me by St. John, who gave much of his time to make my sojourn both pleasant and profitable. We then renewed a friendship that has lasted these fifty years.

My first thought now was to see Sir Charles Lyall. On my leaving Freiberg, six years before, Professor von Cotta had given me a letter to Lyall, which I kept by me through

all my travels. I had studied all of his writings, and I thought of him with reverence.

I had made extensive geological explorations in Japan and China and on the table-land of the Gobi; and I had brought with me an outline of these, the results of the first geological work in the far East, together with my manuscript maps and profiles. During four years I had looked forward to talking these over with Lyall. Now that the long-looked-for day had come I drove with my material to the house and sent up my card. Lyall received me in his study. I said: "Sir Charles, I have carried for six years a letter to you from Professor Cotta. During this time I have spent four years in geological explorations in Japan, China, and Mongolia, and I have thought that you might be interested in seeing some of the results, and possibly willing to give me some advice."

Sir Charles took the letter. As he read it, I saw his brow darken; then he got up and glaring at me, said crossly:

"You couldn't have done a worse thing than to bring me a letter from Cotta. He made a miserable translation of my book."

Then he sat down and turned to his work. That was all; it was a dismissal, and I left.

I had never received a rebuff. A feeling of humiliation was burned into my soul, when, instead, I should have laughed at the unmerited rudeness. It has, however, left through life one invincible effect: of all the letters of introduction that I have carried, I have never since been able to bring myself to present any that had to do with myself personally. It has kept me from making acquaintances that I wanted and needed in foreign travel, excepting when personally introduced by mutual friends.

However, this experience also was a point in my education. It led me always to take helpful interest in the many who have come to me for advice, and especially in the young.

On the same day I met Dr. Lockhart who had brought me through the smallpox in Peking. When I told him of my reception by Lyall he took me at once to see Sir Roderick Murchison, who was then one of the three or four foremost geologists of the time.

Murchison was more than kind. He took great interest in the results of my work, and spent many hours in going with me through the collections in London. I recall an incident in the Museum in Jermyn Street. Noticing some very small masks, made of a pea-green stone, I said:

"Those are from China. They are made of *fei-tsui.*"

"Oh, no," Murchison answered, "they are *Chachihuitl.* They come from Mexico."

On close examination I found them to be really *fei-tsui*—a mineral now known as jadeite. I had made an interesting identification, one that was to be the subject of much discussion, and to be used for years as evidence of prehistoric communication between America and Asia.

Jadeite, though different from jade in its chemical composition, is like it in being harder than steel, and extremely tough. In the prehistoric world it was used in Asia and in Central America as the sharp-edged battle ax, and highly prized for its rarity. After the discovery of bronze, the beautiful and rare pea-green variety of jadeite, which took a high polish, remained in use as a most precious stone for ornament, both in China and in America, and it is still so prized in China. It was so highly thought of in ancient Mexico that there is an instance, shown in the Peabody Museum at Cambridge, where one had been sawed longitudinally into three parts, which were found in separate graves.*

* Professor Brush of Yale University had analyses made for me from specimens I had brought from China, and from one from near the pyramid of Cholula in Mexico. Both showed the same analysis (Dana's Mineralogy), and my thin sections showed identical structure under the microscope.

Now the interesting thing, archæologically and ethnographically, about this identification is that thus far jadeite has not been found as a natural occurrence in America. It served therefore as a basis for imagining a trans-Pacific communication. This idea is, however, no longer held by ethnologists: for an extensive use of Chinese jadeite in America should presuppose the finding there of other traces of Asiatic culture, of which there seem to be none. However, negative evidence is of uncertain value, and until this mineral shall have been actually found as a natural occurrence in America there will remain a perhaps remote possibility of its foreign origin.

The Chinese derive their jadeite chiefly from Burmah; and the only existing clews that point to prehistoric trans-Pacific communication are botanical, and have reference to the borders of the Indian Ocean.

I was able to give to Professor Percy, the metallurgist, information about some points in Chinese methods.

This, my first visit to England, was, in its way, a factor in education. I saw nothing of "London society." My friend St. John took me to Gloucestershire to visit his mother and brother, now Canon St. John. There I had chances to see something of the charm of English homes and home life.

I had been born where people were still striving upward. I had come straight from among a race living under the rigid tyranny of anciently fixed rules. In the English I saw a people in the state of attainment. Here was an adjustment of the balance between action and repose, duty and enjoyment.

There is no better type of good manners than that of a refined Englishman. In Vienna a friend of mine was listening, apropos of an instance of rudeness, to a German who regretted the frequent lack of manners among his countrymen. My friend answered that he had not found the lack so common, and he mentioned the name of Ferdinand von Richthofen, the foremost German geologist.

"Oh! Richthofen, of course, but he is an English gentleman!" the German answered.

Of the return journey to London, I remember only the "White Horse" visible a long way from the train. On a high cliff of white chalk there has been maintained, during ages, an immense white picture of a horse, by keeping the space free from vegetation, and leaving it clearly defined against the surrounding green.

One evening while we were dining at the St. James Club, St. John called my attention to three men who had just come in. "Observe the tallest one," he said, "and I will tell you a story later." Here it is:

"The tall man you saw ran through several fortunes. At last he was heavily in debt, and dared not show himself for fear of arrest. One day seeing in an advertisement that a balloon would go up from Vauxhall, he managed to get to it, and landed away from London. Then he made haste to the Continent, thence to Baden-Baden. Here he played and broke the bank three times. He cleared ten thousand pounds."

The story impressed me enough to stay in my memory; a sequel I will tell later.

I sailed for home on the *Persia*. As Mr. John Bigelow, our Minister to France, had asked me to look after Mrs. Bigelow and the children I did not lack for pleasant companions on the voyage.

I think that it was on this trip that I made the acquaintance of the English general who had commanded the British force in the campaign against Peking in 1860, and who told me about the looting of the Summer Palace that I have already related.

During the first part of the voyage the stormy weather had kept most of the passengers in bed, but as the sea quieted

down the places at the table filled. One day at dinner the talk turned on the play at Wiesbaden, and the methods of playing to break the bank. I said that I was reminded of a story I had heard when dining at the St. James Club—that a man was pointed out to me as having run through three fortunes; that to escape arrest for debt he had got out of London in a balloon, and then to Baden-Baden or Wiesbaden, where he broke the bank three times and cleared ten thousand pounds.

While the people opposite me were laughing, a deep bass voice sounded in my ear from the left:

"Where did you say you heard that?"

I turned and looked aghast at the speaker.

"At the St. James Club," I answered, "and, my God! you're the man."

He laughed: "I didn't clear quite so much."

CHAPTER XXXIX

GETTING SETTLED

I FOUND no longer the America I had left nearly five years before. The war had made great changes. The older people had aged rapidly through anxieties and excitement; the younger generation seemed imbued with a new energy.

The change was the greater to me because the molding period of my life—from the twelfth to the twenty-eighth year—had been passed away from home influences, and, for the greater part, away from the influences of American institutions.

I found myself about to enter on a life in many respects quite new to me. And to what extent was I prepared for it?

My education had been very irregular and incomplete. As a boy in America I had nearly finished preparation for Yale under the then easy requirements, and had done fairly well in Latin, Greek, and history, and poorly in mathematics. My only knowledge of grammar, aside from that of Latin and Greek, was caught by ear in my home life. I was never able to write a composition as demanded at school.

My narrative shows how very desultory my education was during the first two of the six years of my life in Europe. At Freiberg I had had three years of methodical study, though there I was much handicapped by the lack of previous preparation in mathematics. Metaphysics remained outside of my range of study. On the whole, excepting mathematics, I had left off formal study, well grounded in such of the sciences as were likely to be drawn on in my career. Whatever I have obtained of a wider range of general knowledge has

been desultorily gleaned through life from experience and from scattered reading.

There is, however, a broader field of education. One cannot in young manhood be in more or less intimate and confidential and unprejudiced association with men and women of many peoples without getting some insight into the complexity of human nature, into the relation of virtues and weaknesses to subconscious motive forces. Such experience makes for introspection and charity.

I had learned also the sameness of the fundamentals of human nature, whether evident on the surface in the savage or veiled by conventional restraint in civilization, or again in the white man when unrestrained beyond civilized environment.

I had employed men of many kinds and races, Corsican mountaineers, Indians, Mexicans, white men, both normal and outlaw, Japanese, Chinese, and Mongolians; and had learned to understand racial character well enough to be able to get on smoothly.

In Japan, in an official position, under the feudal régime, I had established intimate, in some cases affectionate, relations with my staff of Samurai officers. In extended travels in China my experience had ranged from the receipt of courteous hospitality to the necessity of turning a hostile mob into a friendly one.

In commercial Shanghai I had seen the causes of dislike of the foreigner. In Peking I had been purposely allowed to see at first hand the attempts of a broad diplomacy intended to remove those causes. And as the head of an Imperial Chinese commission consisting of military and civil mandarins I had come into frequent contact with local magistrates, and had seen something of Chinese character in dealings of the central Government with the local democracy.

I had seen Nature in all its aspects, of mountain and desert

and cultivation, between the tropical and Arctic circles, and its corresponding influences on man and civilization.

These were some of the factors in my deeper education up to my twenty-eighth year. If I had been conscious of the fact that I was going through a great school I should doubtlessly have profited vastly more than I did. However, in its gradual growth that school had helped me through dangerous or delicate situations, and had moved me to give weight to the better instincts of men of all races when these instincts are properly appealed to. It had developed in me a racial sympathy and made clear the dangers of racial prejudice.

I found on my return to America an era of speculation already existing, especially in connection with the exploiting of natural resources. The discovery of petroleum in the East, and of the Comstock lode, and the rich returns from some other points in the far West, together with the high premium on gold and silver, had excited the national imagination. Promoters were everywhere offering shares in "mines" which were as a rule mere prospects or worse. Congress was giving subsidies and immense land grants to railroads and canals. "Get rich quick" methods were at work on all sides.

In mining, especially, there existed very few trained experts to develop mines and work ores or to protect intending investors.

In this condition of business I found no lack of professional opportunities. The Janins, busy in California and Nevada, urged the great chances in those fields. Requests came for examinations of mines in Arizona, then but partially safe, and in Mexico and Central America. I was asked to return to China to get concessions for mining coal. Professor Whitney offered a place on the Geological Survey of California. He was to spend the summer in Northampton, Massachusetts, working up the California report, and, before undertaking any professional work, I accepted his invita-

tion to write there in his library the results of my Asiatic explorations.

I spent some happy weeks with my parents in Owego, and the rest of the summer and autumn writing at Northampton. Professor Whitney was very kind in giving me the use of his large scientific library, which was in a detached house on the grounds of the old Jonathan Edwards home. The place belonged to his parents, who were also very hospitable to me. I lived on the next block with the Misses Seager, maiden ladies of the finest New England type.

It was a happy sojourn. The work of writing my first book was most agreeable. For recreation I played croquet with Miss Alice Whitney and her friends, often till midnight in pleasant weather, or in the evening there was music, including singing by Miss Whitney who had a remarkably good voice.

I must repeat a story this lady told me. They had had as guests staying with them a missionary and his wife from the South Seas. The woman was tall and of stern aspect; the man, her second husband, was a small and timid creature. One evening, in an attempt to introduce a little liveliness into the solemnity, Mrs. Whitney asked her sons, just from college, and her daughter to sing some college songs. So gathering around the piano, with their backs to the audience, the young people began "The King of the Cannibal Islands." As the song progressed the missionary lady grew more and more erect and severe, and when it came to the serving up of roast missionary she rose in anger, and with her black silk skirts rustling she walked solemnly out of the room, followed timidly by her shrinking little husband. Then Mrs. Whitney burst out with: "Oh, children, children, what *have* you done! Her first husband was eaten by cannibals!"

In August the National Academy of Sciences met at Northampton and, on invitation, I read a paper on my work

in Asia. Here I made the acquaintance of several of the leading American men of science, especially Professors Henry, Wolcott Gibbs, William Chauvenet, Newberry, Baird, William Whitney, and James Hall, all of whom I became able to count as friends.

Early in September Mr. Burlingame, then visiting America, invited me to come to Boston to a dinner he was giving to Sir Frederick Bruce, who had succeeded Lord Lyon as British Ambassador to Washington. Before going to table I had a delightful talk with Dr. Oliver Wendell Holmes, who asked me difficult questions about my travels. I remember that he was particularly interested to learn what kind of appliances were used in Japan for purposes interesting to a physician. I was able to refer him to an illustrated book which I sent him later.

The guests were Sir Frederick Bruce, Longfellow, Charles Sumner, Dr. Holmes, Governor Andrew, ex-Governor Boutwell, James Russell Lowell, Senator Hooper, Edwin P. Whipple, and myself. I had Holmes on one side and, I think, Whipple on the other.

We stayed at table until 4 A.M. and even I was surprised at the great amount of wine that, under the influence of brilliant talk, disappeared with only the happiest of results.

The next day it was interesting to see what an impression these best representatives of American intellect produced on perhaps the ablest Englishman that had been in America. He told me later that he had never before been at a table where he had heard such a delightfully easy flow of conversation. The impression that Sir Frederick made on the others was equally strong; indeed, his perfect appreciation of American matters, his bearing and fine personality could hardly leave it otherwise.

Two days later the same company met at a dinner given to Sir Frederick by Senator Hooper. It, too, lasted till day-

light and was equally happy. Here I made the lasting acquaintance of Dr. Robert Hooper, which led to a life-long friendship with Mr. and Mrs. Henry Adams.

Of these notable dinners I remember only that the talk never fell off in interest. What impressed me strongly, too, was the fact that at two closely successive dinners the same people could keep up an equally easy current of talk through eight hours without a sign of fatigue.

I remember the last topic was about difficult rhymes, and that Governor Andrew ended it by quoting the one for Timbuctoo:

> "If I were a Cassowary in Timbuctoo
> I'd eat the Missionary and hymn-book too."

Sir Frederick Bruce and Mr. Burlingame had worked together toward the establishment of better relations between China and foreign nations, through greater justice in diplomacy. It was the subject uppermost in their minds, and they wished to bring it before the world through the press. Being Ministers, neither of them could write on a subject that involved severe criticism of both English and American governmental and individual actions. It was for this reason that in Peking I had been admitted to the confidence of these two men in diplomatic matters, and my observations in Japan and China had interested me deeply in the whole subject. I was to talk with the right people in England, and in America with President Lincoln. I must confess that unfortunately my reception by Lyall had made me timid in regard to London and President Lincoln had died before I reached America, so Mr. Burlingame's letter asking Nicolay to introduce me remained undelivered.

So now at a meeting in Boston it was decided that Mr. Edward Cunningham and I should write on the subject, Mr. Cunningham's experience as a merchant in China qualifying him from the side of the commercial problems involved.

There was being created a new department of Geology at Harvard under the Sturgis-Hooper endowment, and it was to be organized by Professor Whitney, who was to hold the chair of Geology. Whitney asked me to take the professorship of mining. Instruction would not begin till after several years, and he wished me then to lecture on geology until he should be ready to do it himself. Until the fund should have grown enough to give me a salary of $3,000, I was to have $1,500 yearly. The proposition as I accepted it would leave me free for several years.

In October Professor Whitney was asked by the State Commissioners to examine the Hoosac Tunnel, then building, where the condition of the rock was causing serious trouble. He recommended me, and I took with me, as topographical assistant, James T. Gardner of Whitney's California survey.*

In December I left Northampton, and stayed in New York until March, seeing to the engraving of the maps, etc., of my *Geological Researches in China, Mongolia, and Japan,* and then went to Owego to be at home for the summer. The Smithsonian Institution accepted the manuscript for publi-

* The tunnel, about five miles long, was being excavated through sound rock from the eastern end, and both east and west from the bottom of a large shaft about 1,200 feet deep sunk half-way between the ends. But at the west end the rock had been so altered as to act as badly as a quicksand. It was important to learn whether this condition was likely to extend far into the mountain.

Seeing that the problem was as much one of geological structure as of engineering, we surveyed over the mountain, a profile of the whole length of the tunnel and westward across the valley and over Mount Graylock.

On this profile I platted all the data of structure at every outcrop of rock. I realized then how valuable to me had been the close attention I had given to minute details of structure in my youthful studies in the mountains of Corsica, for this had led me to infer that the structure in a specimen might repeat in miniature that of the great rock masses from which the small piece had come—an inference I had drawn before the idea had been published by Heim. It enabled me to determine along the western slope of the mountain, near the western end of the tunnel, a zone of folding and crushing in a rock of a character subject to atmospheric decomposition; and from this I was able to estimate proximately the relatively short extent of the trouble, all of which was soon confirmed by the actual work of construction.

cation as a Monograph. This brought about several visits to Washington, and a closer acquaintance with Professors Henry and Baird.

In New York James P. Kimball, my fellow student at Freiberg, had organized a mining bureau to make reports on mining properties, and for this I made a professional trip to examine a copper property on Keweenaw Point, Lake Superior.

I don't remember how valuable my report may have been to my employers, but the experience I gained in visiting the copper region, its geology and its mines through much of its length, was ever after of great use to me. I saw things then that were no longer to be seen six years later, when, as State Geologist, I made the survey of the copper district. Miners were working fissure veins crossing the formation, in which were enormous masses of solid metallic copper.*

In driving on the only road that extended through the great Keweenaw Point I was shown, near a solitary log house, a pit which was said to have been the discovery that led to the wealth of the Calumet and Hecla mine. The story was that the owner of the log house had missed a pig for several days. At last frequent squealings were traced to a hole between the roots of a large tree. A little work exposed a pit about six or eight feet square and as deep, into which the pig had fallen.† The pit had been excavated in a hard con-

* These masses, one to two feet thick with a superficial area of hundreds of square feet, could not be broken by blasting, and had seemed to be hopelessly unrecoverable until some one thought of cutting them up with cold-chisels. At the time of my visit they were being successfully recovered by cutting, with narrow chisels, channels, vertically and horizontally, entirely through the mass, and so getting the copper out in regular blocks about six feet long by two feet wide. And the long narrow shavings of copper produced in chiseling actually paid for the work of mining these masses. These blocks were shipped to the smelters, where they were smelted, one at a time, in a special kind of reverberatory furnace whose whole top was lifted to let the block in.

† This is the story that was current at the time and as told me by the occupant of the neighboring home of the pig. There are conflicting

glomerate, and this rock was full of native copper. It had been the work of the forgotten race who had mined over the whole copper region of Lake Superior, including the distant Isle Royal. It is a fact that all the mines till then opened by modern miners were started by the indications given by ancient workings. Of the great number of "Indian" pits discovered, every one was in copper-bearing rock, while only a small percentage of modern prospecting pits showed copper. How these ancient prospectors were able so unfailingly to find the metal is still a mystery. One is almost led to look back to a time when there was no vegetation on a surface left largely bare after the ice of the last glacial advance had retreated to that latitude. However that may be, it was long enough ago for decided physical changes to have taken place since.

The long peninsula called Keweenaw Point is cut almost through on the east by Portage Lake, leaving only a swamp and a ridge about thirty feet high of stratified sand and gravel, to separate the eastern half of Lake Superior from the western half. A ship canal, with whose construction I was incidentally connected (1866-68), was cut through the swamp and the ridge. In the progress of this work there appeared evidence that this had been used as a canoe route by the ancients. I have a finely fashioned copper point, perhaps of a "setting pole," which we dug up in excavating through the swamp. Visible specks of native silver showed that it had been hammered and not cast. Again in digging a trench on the top of the ridge there was found a burial place where, about four feet deep, in the clean yellow-white sand there was about six feet in length of blackened sand. At one

accounts, "the pit was in the Calumet conglomerate but had been used by the ancient miners to store copper." James D. Hague wrote a pamphlet ascribing the discovery of the copper-bearing conglomerate to Hurlburt in studying the relation of the varying declination of the needle along different beds of the cupriferous rocks. I like to believe that credit was fundamentally due to the pig.

end there lay a large copper knife, and at the other end a well made copper adze. There were no human bones, no hair, no nails or teeth; only the tooth of a small animal, and this preserved by the copper which it touched and which had stained it green.

Remarkable evidence of change in the height of water in Lake Superior was had in the position of another object which I also have. The dredge cutting through the ridge, from the west, kept a vertical cliff ahead of it. The foreman, seeing one day a green spot in this face, stopped the machine and dug out a copper knife. He showed me the spot just under a layer of gravel, and about fourteen feet above the level of the lake, and fourteen below the top of the ridge. Now since that knife was dropped into its place, the gravel and fourteen feet of overlying stratified sand must have been deposited, and after that the level of Lake Superior must have been lowered at least twenty-eight feet. This may mean one of several things: (1) the cutting down the sandstone dam of the Sault Ste. Marie; (2) a tilting in the reverse direction from that which is said to be now in progress; (3) that we are in a long period of slowly progressing evaporation; (4) capturing by Hudson Bay of great lakes and rivers that may have formerly been tributaries to Lake Superior, or perhaps two or more of these causes combined.

On this trip I spent a few days with James Hague, who was developing the Albany and Boston mine, and under whose guidance I was able to see thoroughly both the larger mines and mills and methods of recovery of the copper.

My way back to the East brought me to Marquette, in the iron region. Iron ore had been discovered several years before. Mining, smelting, and shipping ore had already become an active industry. Marquette with its neighboring ore-producing region was a busy oasis on the edge of a vast

primeval forest, almost untrodden and, roughly, 500 miles long and 100 miles wide.

On the northern side of this wilderness, near Lake Superior, lay great iron and copper districts. On the southern edge, near Lake Michigan, sawmills were manufacturing lumber from the great pine trees of the neighboring region.

What I had seen of the copper and iron and lumber on the margin of this virgin country aroused my imagination, and I determined to explore its innermost secrets. So when I reached home my brother and I agreed to take what money we could put together and begin the exploration the next summer.

The United States Government had made large grants of land to the different states for agricultural schools, and issued to each state scrip to be used in selecting the land. Some of these states had sold this scrip, preferring the money to the land, and, while the regular Government price for land in Michigan was $1.25 per acre, the Agricultural College scrip sold in the market for sixty cents an acre. I saw in this a great opportunity.

In October, 1866, James Hague visited me in Owego, and we decided to make a trip in a rowboat down the Susquehanna River, and visit the coal mines of Pennsylvania, and then go to Pittsburgh. My cousin, Josiah Collins Pumpelly, was to be one of the party. A boat quickly made, and stocked with provisions and our valises, lay moored to the bank by the garden.

As we left the house Hague said:

"Oh! I've forgotten something. Before I left Lake Superior Daligny offered to sell me 1,000 shares of Calumet at a dollar a share, and I made up my mind last night to take them. I'll just go back to the house and send him a check."

When I reminded him that his things were in the boat, he decided that he might wait for a more convenient time. It

was the loss of a great chance, for when the convenient time occurred weeks later at Pittsburgh, and my friend found the quotations in a Boston journal, the price of Calumet stood at seventy-five dollars, and later each of those thousand shares became four shares. Calumet and Hecla shares have sold at $1,000 each after having received more than $1,000 in dividends.

However, in blissful ignorance of this opportunity, we happily wound our way down the river. Time did not count. We stopped to see the geology, we rowed or drifted, and when we grounded on gravel bars we got out and eased the boat across to deeper water.

Once, in trying to reach a village in a densely dark night, we heard a roaring of water that grew louder and louder till we knew there was danger ahead. We had to moor the boat and spend the night on the bank where a canal lay between us and the inviting light of a farmhouse beyond. In the morning we found that we had just missed going over a high dam; and we still had an exciting trip down a sluice.

The valley was cut a thousand feet deep into the great plateau, and nearly all the way to Wilkes-Barre the cliffs and declivities were ablaze with the gorgeous autumn foliage of a primeval forest.

The first night we stopped at the house of a cousin at Athens, near Tioga Point.

The history of Tioga Point dates back to the end of the eighteenth century. My grandfather, George Welles, after graduating from Yale in 1779, together with his brother, Ashbel, engaged in building ships and trading with the West Indies and Baltimore. He entered into partnership with Mr. Richard Caton—father-in-law of Mr. Charles Carroll of Carrollton. Among other ventures they bought some large tracts of land, including Tioga Point, in Pennsylvania at the junction of the Susquehanna and Chemung rivers, near the

New York boundary. Disputes with one of the original owners about the title led to a litigation that lasted nearly thirty years, in the courts and in successive legislatures, and even became a political issue. During it all my grandfather was financially ruined, and Mr. Caton at least nearly so, having transferred his interest and George Welles's mortgage to Mr. Carroll. In the end George Welles's son Henry and Mr. Carroll gained the case, and, after his father's death, Henry Welles became the owner of Tioga Point. In the meantime my mother was born in the neighborhood, and another brother, Charles F. Welles, had settled at Wyalusing.

A half-century before our trip this same voyage had been made by the exiled Louis Philippe and his brother. They had been guests of my uncle in Owego, and, I think, of my uncles at Athens and Wyalusing.

Our boat trip ended at Wilkes-Barre. As we landed, a porter, in taking out a demijohn and the box and basket that had contained provisions, spoke sorrowfully of emptiness of the first of these. This moved Hague to make a song of which I remember only the refrain:

"There ain't nothin' in the basket, the box, or *demijohn*."

Here we were entertained by a Welles cousin, my mother's nephew, through whom we were able to see the great anthracite mines and the methods of getting out the coal and preparing it for market.

We reached Pittsburgh. At the hotel Hague saw the quotation of Calumet stock, and I admired the philosophical view he took of the disappointment. Fortunately, he could not see down the long vista of high dividends, nor the points at which offers of $1,000 a share were to be made.

We saw all the important furnaces and mills and coal mines, and the manufacture of coke.

In the Ural Mountains I had been allowed to study the method of making Russia sheet iron, which was still a secret to the outside world, and I had hoped to be able to find a mill where I might experiment in producing it here. However, although I found ironmasters who showed interest in the plan, none were willing to risk the moderate sum needed for a plant for experimenting. So I described the process in *Across America and Asia.*

I have an impression that we went on to Oil Creek to see the process of drilling for oil.

During my absence from America my mother had become very deaf and I had promised to write for her a narrative of my travels. So I began to write a concise account, but it soon became evident that no brief presentation could include the great amount of incidents and adventures of five years of life under such peculiar conditions in so many parts of the world. So I settled down to make the narrative of my travels *Across America and Asia* which was published by Leypoldt and Holt, the latter my old schoolmate. I began it during a visit to Athens at the charming home of my cousin, Colonel Charles F. Welles, Jr., where a bevy of interesting and interested younger cousins, in making me tell of my travels, caused me to refresh my memory.

While at Athens I received from the Smithsonian Institution the first copies of my book, *Geological Researches in China, Mongolia, and Japan.* It was my first book, and when I recalled the scenes and adventures that formed the background out of which the material had been gathered, I doubtless felt unduly proud of the result that now lay before me.

In this mood I began the paper that was to have been written jointly with Mr. Cunningham, but which it now fell to me to write. I had already made many notes, but found it impossible to get in the libraries any authoritative or official

details of events in the years following 1860. An appeal to Sir Frederick Bruce, then British Minister in Washington, brought the following letter:

British Legation, Washington, December 30, 1866.

My dear Sir:

On receipt of your letter I instituted a search among the archives of this Legation for the published Blue Books containing the Chinese correspondence between /60 & the present time. After hunting everywhere I am sorry to tell you that there is not a single number to be found. I cannot understand it as I was certainly under the impression that they were to be found here. But I suppose I was mistaken—

I think however that they ought to exist in the Library of Congress. I know it possesses the Reports of all the Parliamentary Committees which have been published, & it is not unlikely that they may have a copy of the papers laid before Parliament. If you wish it I will inquire—

I have not a single paper in my possession here on Chinese affairs, except the letter I inclose which contains the practical result of the policy worked out by Mr. Burlingame & myself. The American "Diplomatic correspondence" of the last two or three years contains Mr. Burlingame's despatches & several inclosures from myself upon the "coöperative policy"—and the "Edinburgh Review" in a No. published in /65 or early in /66 contains an article on China & Japan by Sir R. Alcock which may be of some use—Unfortunately I don't possess it—

On trade you will find Williams "Commercial guide" good authority & by all means get the *last* Reports issued by the Chinese Customs—There is I believe a general introduction by Hart which ought to be very valuable, when taken in connection with a Report furnished by him to me in 1865 & laid before Parliament which gives a sketch of the C. House system in China before & after the inauguration of the Foreign Inspectorate—

I shall be very glad to apply to the Foreign office for these papers if you wish it—and I need not say that it will give me great pleasure to give you my ideas on any point at which you may wish to consult me, in a confidential shape—for you to reject or use as your own—When your work is a little advanced, I could do so easily,

if it suits you to come to Washington—It is so important to the future of the East, that the case should be fairly and dispassionately stated, & you are so well qualified to do it, that to be of assistance to you will be for me a labor of love. I have lost none of my interest in those countries, and sober reflection has only confirmed me in my high appreciation of the qualities of the people & of the statesmen of China. The great fact remains, that since /60 they have pulled through their foreign difficulties, and have done much to improve their internal condition without impairing their authority or their rights. We can claim for the "coöperative policy" that it contributed largely to that end: that the moderation impressed upon foreign Ministers by their agreement to act together, kept the individual representatives within bounds, and that the support given to the Custom House system affords the best and indeed only hope of assimilating pacifically the Chinese administration to the exigencies of Western intercourse & ideas. I believe that if the policy then sketched out is steadily adhered to, and the Chinese are brought to rely on our friendship and good faith, we shall have little cause to complain and the march of progress will be soon accelerated. The speed with which changes are effected, bears some relation to the size of the area where the changes are to be introduced, and to the numbers of the nation which it is sought to impress, a truth we are very apt to forget.

Yours very faithfully,

Frederick W. A. Bruce.

Raphael Pumpelly, Esq.

Early in February I sent my manuscript of "Western Policy in China" to the *North American Review*, and received the following letter from Mr. Charles Eliot Norton:

Cambridge, February 12, 1868.

Dear Sir:

I have delayed replying to your note of the 2d inst., in order, before doing so, to read again your paper on Western Policy in China. I succeeded in doing this yesterday, and my impression of the interest of your essay was confirmed.

I think, however, that . . . you will agree with me that a little fuller & more detailed historical statement of the proceedings that

led to the last war, & of the events that followed it, is desirable. . . .

If you can return the paper to me in the course of a fortnight I can perhaps insert it in the April number of the Review. . . .

I beg you to accept my thanks for the offer of your manuscript to the Review, & to believe me

Very truly yours,

C. E. Norton.

Raphael Pumpelly, Esq.

I had feared that my paper was already too long and was glad to be allowed to enlarge it.

Before sending the original manuscript to Mr. Norton I had sent it to Sir Frederick Bruce, who wrote back:

April 18, 1867.

My dear Sir:

I have read attentively your MSS. on Western Policy in China. And as you will see I find only one alteration to propose. It is not of much importance, except that it shows how tenaciously the Chinese adhered to the policy of closing Peking. When they found that Mr. Ward would not agree to perform the ceremonies required for an interview with the Emperor, they told him they did not know why he came to Peking where the ratifications of the treaties would be exchanged.

Your statement of what has been done in China, and of the policy which ought to be pursued, is admirable, and leaves nothing to add, or to retrench. It will be of great value in correcting false ideas.

I should like much to visit you in your encampment on Lake Superior, but I do not anticipate a long enough holiday.

Yours faithfully,

Frederick Wright Bruce.

Raphael Pumpelly, Esq.

This ended my only excursion into the realm of politics.

CHAPTER XL

ON LAKE SUPERIOR

About this time Mr. Henry S. Welles came to me with a proposition. He and some other gentlemen had got through Congress two land grants to build a ship canal across the peninsula of Keweenaw Point on Lake Superior, intended to greatly shorten the distance for shipping from the western to the eastern end of the lake.

One grant was of 200,000 acres assigned as in railroad grants in checker-board fashion to consist of contiguous odd numbered sections nearest to the line of the canal. The other grant was 180,000 acres of odd numbered and 20,000 of even numbered sections. They could be taken in tracts of from forty acres upward anywhere on unoccupied Government land in the great region of northern Michigan from the east end of Lake Superior to near the western end. And to give time for the selection, all of the odd numbered sections were withdrawn from the market.

The company wished me to manage the selection of the lands of the second grant; the first had been already assigned by law.

I objected to accepting this proposal, which would prevent carrying out the plan I formed for an independent exploration. Mr. Welles replied that there was a vast amount of land that had been granted to the state, and that this, not being open to the company, would be open to me. He then asked what amount of salary I would wish. I said $10,000, and he answered they would make it $12,000.

I agreed on condition that I should have an absolutely free

hand as to all details and as to amount to be expended, to which he agreed, only they wished particular attention to be given to exploration for gold and silver. This I refused to have anything to do with, and I finally convinced him of the great opportunity that probably lay in the abundance of white pine and in the possibility of finding iron ores.

As my work was to begin the following spring, I took up my abode in the Oriental Hotel in Lafayette Place, New York, and here gathered together and studied all the maps and literature relating to the region in question and regulations of the U. S. Land Office. At the same time I continued writing my book.

In April of 1867 I saw my mother sail on the *Great Eastern* to join my sister in Europe.

Early in May I began my duties at Marquette by studying the intricacies of the local U. S. Land Office records and plats, and by getting well acquainted with the Register and Receiver. As my explorations form part of the unwritten history on the development of the iron industries of Lake Superior, I have been asked to speak of them in some detail.

The whole upper peninsula had been surveyed by Houghton and Burt about thirty or forty years before in a thoroughly honest and excellent manner. Burt had invented and used a solar compass which added an astronomical factor to the efficiency and more precision than was possible with the surveyor's compass.*

At the same time I planned my scheme of work and organi-

* The entire region was subdivided into townships six miles square and each of these into thirty-six sections. All the lines bounding these sections were blazed, corner posts set at each corner, and posts also set on all lines half-way between corners and the number of each of the sections surrounding the corner cut with a gouge on a neighboring tree.

The declination of the needle from true north was determined at each corner and at each half-way post, and at any point where the declination was abnormal. Streams, swamps, and lakes were marked as found.

All of these data were indicated on the maps in the plat-books in the Land Office at Marquette, each sheet representing one township.

zation. It was my intention to send into the great forest parties to explore for pine, each with an expert estimator at the head, with one or more experts under him. I reserved for myself the work of exploring for iron. As my assistant I had engaged Hermann Credner, who later became Chief of the Geological Survey of Saxony.

The most important point was to find trustworthy men for the pine exploration.

Lumbermen had during the winter bought up a great deal of the Agricultural College scrip that had been thrown on the market, and were already beginning to select, from the even numbered sections, tracts rich in pine. This had brought to Marquette many woodsmen who had no capital, but who knew how to estimate roughly the amount of pine on a forty-acre lot. Some of these had already made lists of lands they had estimated, which data they offered to sell for twenty-five cents an acre. Where these lists showed a high average of pine I agreed to pay after reëxamination. Some men I engaged by the month. All of the parties had to be equipped and provisioned.

There were no roads throughout a region 300 miles long and forty or fifty miles wide. There were a few old Indian foot-trails, and the streams were navigable by bark canoes.

In most cases it was possible for a party to reach by canoes its allotted field fifty to eighty miles distant; after that the supplies had to be carried by men on their backs.

The equipment for each party of three to five men was a shelter tent and one or two canoes, a dish pan, frying pan, two or three pails telescoped, tin plates and cups, and each man had an ax and a pair of blankets.

The provisions were flour, baking-powder, pork, beans, dried fruit, salt, sugar, and tea. Since the custom was always to take two teaspoonsful of sugar, the best granulated was bought, because a spoon could lift only half as much of it as of brown sugar and this made much difference in weight.

Each party was provided also with tracings on linen of the maps of the townships allotted to it. These maps, on a scale of two inches to a mile, showed the data given above, and the tracts that had been already sold, for each section was divided into sixteen forty-acre lots.

Each party had assigned to it a rather large number of townships. From time to time a man would be sent to Marquette with a list and estimates of lands selected, which in my absence he handed over to the Land Office to be checked on the office plats. He returned with a load of provisions.

After getting all these parties off, I set about studying the geology of the Marquette iron district and the characteristics of the formation in which the ore occurs. In this I was helped by Major T. B. Brooks, vice-president of one of the larger iron mining and smelting companies. Major Brooks had already mastered the geological structure of the Marquette district.

Then with Credner, and four Indians and two canoes, I started down the Michigamme River on an exploration for iron ore. Our provisions were the same as described above.

Our tents were of a form designed, I think, by Major Brooks. They were made, for lightness of weight, of strong unbleached sheeting. When erected over a ridgepole supported by two poles forked at the top, and guyed by light ropes, they resembled a house nine or ten feet long with steeply pitched roof and a wall two feet high. Both ends were closed and the whole of one side parallel with the ridgepole was open to a height of six feet. A "fly" of the same sheeting was stretched over the ridgepole and far enough out to give us a floor space of seven or eight feet from front to back.

A sod cloth eighteen inches wide lay flat inward on the ground weighted down by stones or earth. A thick bed of hemlock or fir boughs covered the whole earth surface in the tent and on this we spread our blankets. At night a fire of logs seven to ten feet long was made in front of the tent. The men had an ordinary wall tent. For light to write by at night we used candles held in pointed sticks split at the top and stuck in the ground.

The forest abounded in deer and beaver; the streams in trout, and the lakes in bass, pike, and pickerel, but we rarely attempted to get venison though we caught plenty of trout.

I had hoped to find that the ore of the Marquette range, and its accompanying rocks, would be typical for the region I was about to explore. I soon found that this was not so.

My plan was to descend in canoes the Michigamme River, exploring on each side and up its tributaries. We should have to go far before reaching the point where our land grant began. On the way we explored for outcrops that might give light on the geology. Wherever we found ore formation it and its geological relations differed in character from that of the Marquette district. In any event, a definite clue in the form of an outcrop of iron ore was desirable and I was priming my hope on a statement in the Foster and Whitney report that Burt in running a random line had seen some magnetic iron ore at a point that should be near a given township corner to be established by the final survey. This would place the locality twelve or more miles from the river. As it would be in a dense forest and dependent on the uncertainties of "random lines," the problem was that of the needle and the haystack.

At last we entered the limits of our land grant and, to hunt up Burt's clue, we were to leave the river early the next morning. Our canoes were *cached.* All the provisions not needed during a two weeks' absence were hung in sacks on horizontal poles high above reach of bears and porcupines.

Suddenly there came the sound of paddles, and from a canoe there stepped a visitor who said he was Jack Armstrong, and was exploring for pine.

At supper he learned the route we were going to take, and which survey line I intended to follow. He knew already that I was looking for iron ore, and he was evidently uneasy, and tried to divert my course to a different

direction. At last he said he could show an outcrop of ore like that at Smith Mountain,* and would sell the information.

I felt that such a clue, if the formation was like that of Smith Mountain, and even though the ore itself should probably be inferior, would be of the greatest value as a starting point. Although I suspected that his outcrop might be the one I had in mind, I knew that we might look long and still fail to find it. So I agreed to give Armstrong an order for $1,000 provided that examination should show the ore to be as he described it. He then indicated the spot I was going to look for. He had been afraid I would find it, for although, as it was on an odd numbered section, he could not take it, he had hoped to sell the information or to wait until the lands should be thrown open.

On the way I struck with the dip needle a line of magnetic attractions that continued to the section we were going to, but even with Amstrong's guidance we had much difficulty in finding the outcrop.

The occurrence did not resemble that of Smith Mountain, but there was some rich specular ore, and enough evidence of a well-developed iron formation on the section to make the information valuable, and I gave the order for $1,000 and took Armstrong into my party as woodsman. He proved to be a very valuable addition, being both a capable woodsman and thoroughly honest.

Half of the even-numbered section to the west of this one, and an outcrop seven miles eastward, had already been bought by others, evidently for iron; so I was not the first explorer for mineral, and I was to find that far and wide others had been and were still working quietly for the same purpose.

I now saw that my proper course would be to confine exploration to looking for clues, and at these to study the geological and structural conditions under which the ore occurred; and from these points to trace the continuations

* At Smith Mountain, in the Marquette range, there was a superb development of specular and magnetic ore on which was later established the Republic Mine.

of the iron formation. I would then take up the least amount of land needed to cover a maximum amount of ore formation without attempting to find merchantable ore. And I decided that where I should be in doubt I would take the land if covered with a good stand of hardwood or a small amount of pine.

Turning back, we explored to the west, and for twenty-four miles as far as the Crystal Falls of the Paint River. An occurrence of iron ore at this point was noted on the map by Burt's Survey. We found the outcrop, and I found too that both the ore itself and the geological conditions under which it existed were again entirely different from any that I had seen. Here there was no limestone or jaspar, only various slates and schists and eruptive rocks.

This condition extended with exasperating monotony over a large region. Small pieces of good ore were to be found so frequently that they seemed to indicate at least a possibility of the existence of larger concentrations. So here I selected extensively any land having good hardwoods with some pine. This, known as part of the "Menominee range," is now dotted with productive iron mines.

Our route thus far had been down a river flowing rapidly through a primeval forest, chiefly of maple, birch, oak, pine, spruce, and balsam-fir. Great trees hung over the banks which were often of moss-covered rock. The water, though limpid, was of the color of garnet, due to the action of organic acids on the vegetation and humus in the swamps from which the river was chiefly supplied.

We brought our canoes ashore long enough before dark to make camp and get wood for the night, and to cut boughs and thatch a thick layer of them in the tents to sleep on. The men always tried to find a large fallen dead maple tree to serve as backlog for a fire, then they cut logs about eight feet long; if the night promised to be cold they cut sometimes as much as a cord of these. The fire was then built about eight feet from the front of the tent, whose long open front

and sloping back wall acted like the reflecting surface of a bake oven. Indeed in the winter work the parties often did not carry tents. Even when the thermometer would be far below zero they would spread boughs on the snow; and, making a leaning shelter of a blanket, would sleep warm in the reflected heat in the dense forest that kept off the icy winds.

In our expeditions inland we often had to cross great windfalls that marked the path of cyclones. For a width of half a mile, and along a stretch of many miles, the whole forest lay a prostrate mass of trees with their tops towards the east and their great roots rising high, and leaving the trunks often several feet above the ground. During the years a dense growth of brush and tall briars had grown up to hide the fallen timber, and to give shelter to hidden nests of hornets.

With packs weighing sixty to seventy pounds, it sometimes took us two days to make a half-mile across these windfalls, never less than one day, from early morning till night. On one trip we had to follow the path of the cyclone for half a mile to cross a narrow deep river. Here the forest had been a very dense growth of tall, slender spruces. A fire had run through the fallen timber and burned the fresh growth of briars, as well as the branches and the bark of the trees.

The bare poles lay horizontal and were sound; and being firmly held by the roots, were a mass of parallel spring poles. We walked along these, keeping our balance in stepping across from the small end of one to the root end of its neighbor. Every man carried a heavy pack and a sharp ax. We had got along very well till suddenly a dense swarm of hornets rose from below. It was then *sauve qui peut* with hop, skip, and jump till we could stop, standing or fallen. Packs were dropped, and some fell between the poles. One man came near cutting his throat. In throwing up his right hand to save his balance, the sharp ax cut a slight gash in his neck.

Very often our way lay through cedar (arbor-vitæ) swamps. The moss-covered trunks stood at every angle from upright to flat. The roots, rising a foot or more above the general level and covered with moss and humus, formed a treacherous footing. Beneath these root-knolls there was usually a foot of clear water resting on ice, and till the end of May swarming with the larvæ of mosquitoes. Progress was very slow through these swamps, though it was easier when we happened to find a deer trail that nearly coincided with our course. These trails generally ran north and south in the direction of annual migration. At other times our course lay over sphagnum swamps, often quaking bogs, abounding in pitcher-plants.

Very often we saw the contributions of beavers to the stage of forest growth. There were ponds which they had formed by building dams across a stream at a carefully selected point. In some of these the beavers were still living in their "lodges" raised in the middle of the water. Small canals ran from the pond to the forest. One of these, that seemed to be freshly made, I followed to its source at the foot of a slope on which stood poplars. It was here that the beavers provided themselves with both food and materials to build their lodges and make and repair their dam. Tall trees, up to six and fifteen inches thick, were in process of being felled by the slow gnawing of gouge-shaped teeth. Others lay already fallen and cut up into short logs from the thicker trees, or longer ones from the slender branches, all ready to float down the canal to the pond. The bark would supply food, and then the stripped wood would serve for construction. Truly the beaver was the pioneer lumberman and hydraulic engineer.

On a later trip in the region where pine was being cut to haul to the river we saw a corduroy road of heavy logs just built through a swamp bordering a beaver pond. The

builders had cut the dam, drained off the water, and built the road. After a day or two the beavers rebuilt the dam, and the logs of the road were all afloat!

I remember that on my visit to the copper district in 1866 Hague told me that at one of the mills, where the water was obtained from a beaver pond, in order to increase the storage capacity they broke up the top of the original dam, which caused the beavers to rapidly rebuild to a greater height.

To return to our voyage down the river. At the junction of the Michigamme and Brule rivers there is a beautiful waterfall over twenty feet high, where I had a narrow escape from drowning.

From here we were on the Menominee River, and came upon several high and picturesque falls. In the ponds below these we sometimes found large turtles and sturgeon for supper. At last we camped at the foot of a fall sixty feet high, from where I proposed to leave the river to go north on an Indian trail to a lake.

Foster and Whitney had found blocks of crystalline limestone and traces of iron ore near where the Pine River, coming from the Wisconsin side, joins the Menominee. I had come to recognize crystalline limestone as a probable associate of an iron formation, and decided to explore the region, especially because Foster and Whitney showed a continuation of the limestone further east.

In portaging our canoes and provisions to the lake we crossed a high ridge of limestone and an outcrop of quartzite in thin layers coated with films of specular iron ore. The northern slope, mantled with a superb forest of maple and beech, yellow birch and ironwood, descended to the edge of the beautiful Lake Antoine. Here we made a camp to serve as a point from which to begin the exploration of the immediate region.

I was elated at the thought that this great development of

crystalline limestone might lead to important results that should justify my insistence on making a search for iron ore a principal element in the exploration. Of the importance of pine selections I had had no doubts. I lay long awake till at last lulled to sleep by the distant roaring of the falls four miles away.

To begin as thorough a reconnaissance as possible, of the geological structure of the region, we traced eastward eight miles the limestone ridge and an accompanying line of magnetic attractions, finding, as well, some loose good ore.

During this study, as far as it related to the geology of the iron formation, we accurately outlined the part, east of the Michigamme River, of what is now called the Menominee Iron District; and we mapped the lines of ore formation. These lines lay along two massive limestone ridges between which nestled the beautiful Lakes Antoine and Fumé. The ore formation proper seemed to overlie the limestone.

Some great mines have developed here. I may relate an anecdote connected with one. A man, in Ohio I think, had failed and been stripped of everything. There remained eighty acres of wild land in the woods of Michigan that seemed not worth the cost of valuing. In time an explorer got from him an option for a lease and found one of the big iron mines of the world. It is related that the old gentleman used to sit all day on the dump watching the skips discharge and counting the royalty, "fifty cents, fifty cents."

The high limestone ridges ended abruptly in the cliffs near the Menominee River at the west end, quite beyond which, where they should extend, the country was covered with an apparently younger slate formation.

There seemed to have been a great timebreak between the limestone-ore formation and the deposition of the slates. After a later timebreak the Cambrian Sea had spread its sandstones over all, inclosing blocks of limestone and ore where its waves had washed the cliffs.

I am not writing the geology of Lake Superior. I am merely giving some of the impressions formed in the course of an exploration to outline the occurrences of ore formations.

The persistent continuity of the ore formation proper on both ranges was established by magnetic attractions and occasional outcrops. In places its great thickness of over seven hundred feet in each range, was represented by siliceous ores carrying 40% to 50% iron. These were too low to be then merchantable, but loose pieces of much higher grade, found along the ranges, pointed to the probable presence of merchantable ore.

We found that some forty-acre tracts on even numbered sections where this siliceous ore outcrops had been taken, probably in the course of exploration for pine.

Before the middle of September we had covered with the reconnaissance the whole area within the limits of the grant. Thus I was able to select a maximum of iron ore possibilities with a minimum expenditure of the acreage of the grant. In doing this I selected in this area only 162 forty-acre lots, *i.e.*, 6,480 acres, containing about twenty linear miles of belts of the iron ore series.

Besides these 162 forties I had nearly 100 forty-acre lots on the Felch Mountain range, and a large number of tracts west of the Michigamme River, in the western part of what is now called the Menominee Iron District. There the geological conditions were obscure. Only slates, schists, and green eruptives were visible throughout a large region, and small pieces of good ore—quite different in appearance from the ores of other ranges—were equally widely distributed. So, although it seemed very doubtful whether the scattered occurrence of small pieces of ore in the slates had economic significance, I had selected tolerably liberally lands of more or less value for hardwoods, pine, or farming.

The reader may be interested in the financial result of all this as given on page 589.

Instead of going up the Michigamme I set out with a light bark canoe for a rapid voyage down the Menominee to its mouth, and thence by rail to Marquette. We started from a little isolated Indian settlement called Badwater. Here some Indians had built several log huts in the midst of some hundreds of acres of fertile land—all of it, except three or four acres, covered with a grand forest. They raised some of the northern maize called "squaw" corn, and the women showed with pride some fine potatoes.

I had been there before, and they knew me, and when I appeared there now they exclaimed: "Bid-wey-wey-Gizjek! Bid-wey-wey-Gizjek!"

When I asked what they were saying, one of my Indians said that was the name they had given me. It meant "Sounding Sky."

"Why do they call me that," I asked.

He asked the old man of the group. I saw an expression of sadness on the faces about me as the answer was given:

"These Indians try do same as white man. They make house and plant crop. They think they always live here. The land is good, heap fish, heap deer, heap beaver, and mink and marten, heap fur. Now they say they see you take all land. They think you take their land. Yes, they heap sad."

"Well," I said, "what has that got to do with the name they call me?"

"They think you thunder that come before storm."

So I was the "rumbling of the coming storm."

The tract was an odd numbered section, and I told him to tell the Indians that no one but me could take that during the next few years, and that I would not take it from them; and I added that I would try, if possible, to have it secured to them once for all.

They were very grateful. After a consultation among themselves an old squaw went off and came back with a gift.

The group gathered near, as she proudly handed it to me. It was a freak of three potatoes united to form a veritable phallus. The old men smiled, and the women, old and young, giggled. My interpreter said, "They say this bring you heap papoose." In return for the mascot I made them all happy with tobacco.

Down the Menominee was a charming paddling trip of about two hundred miles. The river often meandered through lowlands covered with large elms. We portaged around great waterfalls, and dashed down long and dangerous rapids, where only the skill of my Indians saved us from destruction.

One of these long rapids was especially difficult. It was full of large sharp-edged and sharp-pointed blocks of white quartzite. Only the greatest skill with paddle and pole could guide the boat safely through the intricate windings of the foaming torrent. A touch of the frail bark canoe against a jagged block might mean drowning.

I remember that at every critical point, in the "shooting" of these cataracts, I felt a stinging thrill on the soles of my feet. I had had this sensation before. In going carefully down the slippery surface of a smooth rock that sloped to the top of a high fall my moccasins slipped, and I narrowly escaped the fatal plunge. With the slipping came the stinging thrill; it was a physical expression of fear in the presence of imminent danger, and it lasted for some time after. While shooting the cataract it came when I was sitting on the bottom of the canoe with my feet stretched out at rest, and even when I was enjoying the excitement of the adventure.

My work was now chiefly at the Land Office. The ordinary routine there was the filing of applications for such lands of our lists as were not already sold. This required a search, both in the plat-books and in the records, to see which in my lists were free and which interfered with an already earned railroad grant, or with

an old and unearned one which might be held to conflict with our canal grant.

The rules of the office were that as soon as an application was found to be valid payment was made to the receiver, and on his certificate the Register checked the entry on the plat-book and forwarded to the General Land Office in Washington an application for a patent to the land. In our case, all odd-numbered sections having already been withdrawn pending our selections, the proceeding was nearly the same, omitting payment.

In my first glance through the plot-books the penciled checkings showed that the cheap agricultural college scrip had already filled the whole upper peninsula of Michigan with explorers for pine. This did not trouble me as regarded odd-numbered sections, but I found that some tracts that I had chosen on even-numbered sections, where there were large exposed outcroppings of ore formation, had been taken for pine.

Some of my pine parties had arrived from the woods, and I checked their lists on the plat-books. Then I sent the men, who had explored in the region east of Marquette, to reëxplore the lands examined by those who had ranged through the southwest, and vice versa. I followed this plan throughout 1867 and 1868. The result showed a rough conformity in the estimates, such as would necessarily vary with the personal equation of men estimating by sight without instrumental measurement. I detected fraud only once.

In the meantime the company had been preparing to dig the canal, and I was called to aid on the spot which I had not yet seen.

The length of the canal was to be six miles. Of this four miles consisted in deepening the outlet at the east end of Portage Lake and two miles to be dug from the west end of this lake to Lake Superior. This western part lay about a mile and a half through a swamp; the rest, a half-mile or less, through a ridge of sand and gravel, as already stated, rising

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to about thirty feet above lake level. My business was to determine the nature of the ground to be excavated.

My soundings showed the whole swamp to be a deep mass of liquid ooze. It seemed probable that the ridge could be traversed by dredges without meeting a bed of rock.

A contractor offered to build the canal for $80,000. I don't remember whether he included the harbor demanded in the Act of Congress. To me this seemed clearly impossible. The bid was rejected because the engineers estimated that the company could build it for $40,000!

So the company started on the track that led in the end to ruin. A mortgage for $400,000 had been made under the authorization of Congress to hypothecate the granted lands, to raise the money to build the canal. When a million had been spent, the company became bankrupt and it took $800,000 more to finish the canal under a receiver.

After starting the parties to explore for pine through the coming winter I went to New York to stay there till spring.

CHAPTER XLI

NEW YORK

I HAD no office duties. When needed I went downtown to give to proposing investors information about the lands pledged in the mortgage. So I settled down in my rooms at the Oriental Hotel in Lafayette Place to continue writing on the narrative of my travels.

My friend, R. A. Wight, found an amanuensis for me. He was an elderly retired Baptist clergyman. His presence was not stimulating. He criticized by suggestions, my style, and my recounting certain situations in my narrative. He objected to calling a spade a spade, or even thought it much better in the interest of morality not to mention spades at all. My lack of enthusiasm about missionaries saddened him to such permanent gloom that I began to feel that perhaps after all I might be in need of moral reconstruction. However, the friction culminated when we got to the interview of Takeda and myself with the Japanese lady of rank in the same bath. After that my secretary abandoned me, and I wrote henceforth without aid, fearing only the tardy criticisms of the reader.

Since I set out to note the critical points in my life as affected by coincidences, I give here one that might otherwise well be omitted.

I got a horse, a superb animal. I find I paid $560 for him. His tongue had been cut nearly off by a wire bit in racing. To try him I rode to Central Park. He bolted under the first bridge, breaking the rein at the bit. I had, of course, no control. Then came a race up the bridle-path, and around

the reservoir onto the home stretch. It was a mad career along that beautiful path, shying at bridges and scattering frightened parties of riders.

And all the time I knew that death stood waiting for me when the horse should touch the smooth Belgian pavement of Fifth Avenue. If I had had a whip with a lead knob I could have felled the animal with a blow on the base of his skull, as I had done once before in Japan. As it was I could only keep a firm seat.

As we neared the southeastern exit from the park my heart gave a bound. Fifth Avenue, from 58th to 59th Streets, was packed with carriages halted by blasting further down. The blocking extended into the unpaved circle where carriages coming from east and west were waiting. Into the *cul-de-sac* between these my horse plunged and came to a stop. Death was cheated. I was young enough to be glad that my hat was still on my head.

Only the coincidence of my arrival during the few minutes of delay of traffic stood, doubtless, between me and the unknown.

I liked the horse so well that I tried him again in the park, where he promptly bolted onto the grass, but after a long contest he understood me and we became the best of friends.

When, years later, I left Boston I sold him and I heard later that he had killed a jockey in New York.

I was made honorary member of the Travelers' Club, and joined the University Club, and was also elected into the Century. These three clubs were, in their average memberships, representative of as many phases of New York's activity. The Travelers' was perhaps intended to bring together wanderers and city men. Many of the wanderers were from the Western mining regions, then the lands of romance. Out of a background peopled with characters of

Bret Harte and Mayne Read rose alluring visions of sudden wealth. The cocktails were good and frequent. My old friend Poston lived there, and he was always interesting—also interested.

The University Club contained men who were to become leaders in the professional and business life of the nation.

I felt it to be a great honor to be elected at my age into the Century—into contact with the brains of the metropolis. I came to know more or less intimately most of the members of that time, and I count this daily association with men in such varied fields of thought and action as perhaps the most broadening phase of my education.

Of all those whom I knew in those earlier years only four or five are still living.

One of the first friendships I made at the Century was with John La Farge. He became interested in my collection of Japanese and Chinese things. There were hundreds of old Japanese prints, and representations of good periods of Chinese art in jade and rock-crystal, cloisonné and bronze.

They had been carefully selected from the vast accumulations in Chinese shops, and without any expert knowledge or other guidance than my own feeling. So I was greatly pleased by the appreciation of an artist.

La Farge became so interested in the art of Japan that he wrote the chapter on it for my book *Across America and Asia*. An interest in this Eastern art was just beginning in France, but I think that this essay by La Farge was about the first on the subject. La Farge was always, I think, quite as much interested in the philosophy of art as in anything else relating to it. And during our sessions among my things, and indeed during a life-long acquaintance, I profited much from his broad historical and technical knowledge and clearness of statement.

Bernard Roelker was another friend in whose bachelor

quarters I spent many evenings. He was a German of the old school of romance and philosophy. He had two hobbies, Spinoza and Charlotte Corday, whose engraved portrait hung on the wall. Philosophy was an unknown field to me, but Roelker's love of Spinoza struck in me a sympathetic chord, for I had a pantheistic conception of my own which these suggestive talks helped me to formulate.

It would be hard to overestimate the value of the Century to a young man interested in everything and still in the formative period. Little groups gathered in the easy chairs to talk under the amiable accompaniment of cigars and moderate libations. These informal talks brought out the different points of view derived from individual thought and experience. And since in different casual circles they covered a large range of intellectual activity they were for me of value as a desultory phase of education.

Socially I had a good time in these—the only two winters I have ever spent in New York. A number of houses were open to me. In some of these I dined often. The dances did not interest me. My dancing experience had been in Europe, where the great rooms and polished floors allowed freedom and *élan* in alternating kinds of dances. In New York in those days the rooms were relatively small, and the dancing almost confined to a slow waltz on carpeted floors. So on such occasions, being generally among people I did not know, I was merely an onlooker.

I remember, however, one occasion, Mrs. Christine Griffin, who was a cousin of my sister-in-law and was very kind to me as a stranger in Gotham, invited me to dine and to stay to a little dance she was giving "to bring together the seven most beautiful girls and the seven richest young men in New York." It was an interesting excursion into Mayfair. The fair guests, and very fair they were, could not wholly hide their feelings of the possibilities involved in the meeting.

Mrs. Botta, Mrs. Youmans, Mrs. Henry Field, and Mrs. Professor Chandler, all now gone, had regular evenings on which there gathered a small number of people of intellectual distinction, Americans or foreigners; and the house of my New Haven schoolmate was always open to me.

I always found a welcome in their houses, in their dens or laboratories, from William C. Prime, Newberry, Chandler, Rood, Lewis Rutherford, and John La Farge.

I had the good luck to be admitted to a small group of interesting young people—nearly all married couples. There were two who were much in love with each other, but the man was afraid to come to the point. The ladies asked me, as being the only available bachelor in the group, to arouse the laggard to action by paying attentions to the girl, who was not to know of the plot. Miss —— lived in the country several miles from the city. The suggestion appealed both to my love of adventure and to my sympathy with the lovers, and it offered an objective for pleasant trips on horseback. I found the mission very nice, and made several calls; but when it came to moonlight strolls with a very attractive young woman, it struck me that I was playing a dangerous game. However, in the meantime, my co-conspirators had so tactfully worked upon the lover's fears that he proposed and was accepted.

In the spring of 1868, after a visit to my father in Owego, I again took up my work on Lake Superior.

During this summer the lists of the pine explorers of the past winter were checked by reëxamination, and the final lists forwarded to Washington, so that the whole floating grant, excepting some even sections, were certified by the General Land Office to the Canal Company.

In the meantime I was called twice to the works at the canal, and made flying trips to revisit the lands taken for iron ore possibilities, and other excursions to study in more

detail the geology of the Marquette region. It was on these last that I took with me, as stated before in telling of the mouflon, the Duke of Würtemburg and his nephew. Among the stories told around our camp-fires I remember one told by the Duke. Some years before his uncle, Duke Paul, had traveled in the United States and had passed a night at a village in Wisconsin. The next morning he ordered a carriage to take him to a place several miles distant. While he was waiting in the office of the inn a man came in and, walking forward, slapped the Duke on the shoulder, asking:

"Are you the fellow that wants to go to Mayville?"

"Yes, I wish to go to Mayville," answered the startled Duke.

"Well, I'm the gentleman that's goin' to drive you."

On these trips the conditions were not always comfortable. We had some cold rains, and sometimes camped in swamps, and went across one narrow but soul-harrowing windfall. My guests had insisted that no change in my camping methods should be made on their account. And no one could have gone through the experiences with a better spirit of *camaraderie* and enjoyment than did this old man of seventy and his royal nephew.

The uncle seemed a good botanist, and had a good layman's knowledge of the geology of the period; and at the mines he took careful notes. Without appreciably interfering with my work he added to the pleasure of the excursions.

On our way back from one of these trips we spent the night at the Washington mine, as guests of the owner, Mr. Edward Breitung, a German, whose son is now (1915) stirring diplomacy as owner of the *Dacia*. It turned out that both the Duke and Mr. Breitung had been pupils at the same school in Germany, and they had a long evening telling reminiscences over bottles of good beer.

All of which reminds me of a quite different evening at

Breitung's hospitable home not long after this. On my way to Lake Superior in the spring of the same year, on the steamboat from Green Bay to Escanaba (the railroad had not yet been built over this stretch), I had met a man whom we will call Jones. He had iron works in Ohio, and was going to see whether some lands, in the copper region, which he had taken in a trade, were of value. As he was densely ignorant about the region generally, and about the manner of occurrence of copper, and wanted advice, I went over the whole matter with him. In return he told me his life history. As a small boy he had been an orphaned waif adrift in a city, in Vermont I think, and in rags! "One day," he said, "a kind and beautiful lady asked me if I wouldn't like to have some nice clothes and go to Sunday School. No one had even spoken a kind word to me before. She was the angel that saved my soul. She clothed me and took me to Sunday School, and made me go to day school. This was my start in life. Through the Sunday School and the Bible I became interested in religion. With the help of that lady I was able to get jobs that enabled me to work my way through school, till I could get permanent employment. Through the meeting with that lady I have been able to work my way upward till now I own large iron furnaces."

It was told very simply, and it interested me not only as a bit of life history, but as evidence of the width of possibilities open in America, and still more as an instance of the fateful importance of seemingly trivial events.

Mr. Jones gave me much information about blast furnace methods in Ohio, and in parting he said he hoped to get some interests in Lake Superior iron lands.

Now for the sequel: Mr. Breitung had held, from a man in Chicago, an option on a part interest in a property on which there was a large exposure of very rich iron ore. This option he offered to transfer to Major Brooks and me. And

I, remembering Mr. Jones's wish to buy an iron ore interest, suggested that we should offer it to him on condition that he should pay the price, giving us a half undivided interest, instead of ourselves paying $6,000 for the whole. We took Mr. Jones to the mountain and showed him the splendid exposure of ore. He was delighted with it and with the opportunity, and began at once to plan for the development of the property. On the way back we spent the night at Mr. Breitung's. During the evening it came out that Breitung had not heard from the owner in answer to his statement that he had offered his option to Brooks and me.

Mr. Jones was a pious man and proposed prayers before going to bed.

When our host and Major Brooks and I came down to breakfast we found that Mr. Jones had taken a very early train, leaving word that only important business had made him leave so soon. That train connected with the express to Chicago. Jones got the interest in the property, which has for forty years been one of the more important Lake Superior iron mines. He had evidently succeeded in life by capitalizing his piety. It was a new episode in education.

Autumn had begun and my work for the Canal Company was finished. At the last minute there came an order from the General Land Office in Washington affecting the first grant, with which I had had nothing to do. The enabling act which had authorized the grant had stated that it should be of lands nearest the line of the Canal. The department had now discovered that, to meet the requirement, sections covering 20,000 acres would have to be shifted. It was merely a question of making some changes in the boundary of the grant. So I set to work studying the plat books in the Marquette Land Office.

This demand of the Government was, in its results, really one of the most critical episodes in the history of these

remarkable grants for the building of six miles of ship canal. I will show later how it was also fateful for me.

I made a careful examination of the details of the original survey as shown on plats of townships bordering all around the grant. Near its southern boundary I found indicated a series of slight variations of declinations of the compass needle, and these occurred almost in a straight line along a stretch of many miles. In Burt's excellent survey the different surveyors had been instructed to take small specimens from such outcrops of rock as they should cross in running lines. These were marked on the plats. Exposed outcrops were rare, but some were indicated. I noticed that such of them as occurred south of the line I drew through the variations of the needle were of granitic or else of metamorphic rocks. To the north of the line these were absent; instead there were noted "trap," and, at least once or twice, "slates." It was possible that the variations might be due to iron minerals in the "traps," but the presence of granitic and metamorphic rocks south of the line, and of slate on the north, made it also possible that the variations were due to the presence of an iron ore formation. So I shifted the 20,000 acres of odd numbered sections so as to include the iron ore possibilities.

This was to become the great Gogebic iron range of which the Canal Company obtained about one half through its ownership of the odd numbered sections.

When, during the long panic that started in 1873, the Portage Lake and Lake Superior Ship Canal Company went into bankruptcy there began a series of Congressional hearings and cases in the courts, in some of which I had to appear as witness. The lands were to be sold under foreclosure of the several mortgages. The holders of the mortgage bonds insisted on a sale of all the lands in one block. The company fought for sales in parcels. They rightly

claimed that in the then existing financial depression a sale *en bloc* would be ruinous, and that by selling in parcels much might be saved of the immense excess of value of the property over the debt. I testified that they should average seven dollars per acre in quick sales of parcels. Mr. J. M. Longyear put them at $2.50.

As a matter of fact the records show that the pine alone on 186,506 acres has been sold *standing* for $5,945,384—an average of $31.88 per acre—while more than $10,000,000 has already (1915) been received in *royalties* from the iron mines on the grant. So I felt justified in having insisted on exploring for pine and iron ore instead of for gold and silver.

My experience during this work for the Canal Company confirmed me in a decision I had taken on my first visit to Lake Superior. This was that instead of putting any savings I might be able to make into life insurance or savings banks I would invest them in Government lands carrying timber, and in lands having the iron ore formation, whether merchantable ore showed on the surface or not.

I had on my first visit become acquainted with Major Thomas Benton Brooks, and, now that I was free, I told him my plan, and proposed that we should join in buying lands on it. This led to an informal association that lasted nearly forty years. There was no written contract that I remember, only a verbal arrangement to invest jointly such money as we then could spare, in such lands as either of us should think desirable.

Our first joint work was to quickly trace the Marquette ore formation west from Ishpeming along the northern edge of the basin, using the dip needle, and trying to locate the southern limit of the granitic area. After having traced a line of magnetic attractions several miles beyond Lake Michigamme, we sent J. L. Spurr to explore carefully for

ore outcrops along the line. He was to have a third interest in anything of his finding that we should buy. At the same time we sent Jack Armstrong down into northern Wisconsin to explore for pine and for iron on the possible western extension into Wisconsin of the Lake Antoine iron formation. Spurr came back with specimens from a large outcrop of rich magnetic ore. I wrote to the owner, a Mr. Williams, near Syracuse, N. Y., for a price. He answered that he knew the tract contained iron ore, and he would sell the 160 acres for $8,000 if paid by a given date, which we agreed to.

I went at once to New York, and from there, with $8,000 in legal tender bills, I took a night train for Syracuse. The porter woke me at three o'clock saying I had five minutes to dress. On my way back from the toilet room my foot hit something on the floor. The car was very dark, but, thinking some one might have lost something, I spent valuable time in searching for the thing. It was my roll of $8,000 which I had hidden in my drawers next my leg! It was a case of rewarded altruism.

After delivering the deed of sale Mr. Williams told me that a Mr. Palmer of Michigan was interested with him in the property; and soon Palmer wrote to Major Brooks that Williams had written him about the sale, that he had known that the land contained valuable ore, and that he hoped it would prove to be very valuable. All of which seemed very nice. However, when the discovery came to be much talked of, Mr. Palmer entered a suit to recover a third interest in the property, and he won out in the lower court. We appealed to the State Supreme Court, where three judges out of five decided against us.

It was my first experience at law, and it was a very valuable and never forgotten object lesson; but it delayed development of the property for nearly three years.

At last we organized the Spurr Iron Mining Company,

issued stock and bonds, and began to open the mine. The ore body promised to be large, the railroad was extended to it, and we began to ship ore. This was, I think, in 1872.

Among the owners of stock and bonds were Brooks and I, Mr. Moses Taylor, and a Mr. Morgan—an Ohio ironmaster. The bonds were made to run one year. By 1873 we had shipped over 100,000 tons of ore, but as it was evident that we should not be able to pay off the bonds at maturity we all agreed verbally to extend them another year.

Then something happened. In a letter to Mr. Norwell the secretary of the company, Mr. Morgan, had expressed some difference of opinion on some mining or selling question. Mr. Norwell, in his reply, had written that he thought Mr. Morgan was really "hypercritical." Thereupon, without any notice, Mr. Morgan entered a suit for foreclosure of the bonds! Which showed an equal weakness in temperament and vocabulary. It would have been funny if it hadn't been effective.

The Jay Cooke panic, coming on top of the difference between *hypo* and *hyper,* smashed the Spurr Mining Company.

To go back to the autumn of 1868: Armstrong returned with a list of vacant Wisconsin pine lands, incidentally carrying indications of iron ore formation. We bought undivided interests in several tracts having "iron chances" with timber. Within a year we had a scattered holding of a considerable number of thousands of acres. The time for getting lands with more than a very moderate stand of pine had, however, passed.

CHAPTER XLII

GOGEBIC IRON RANGE AND GEOLOGICAL SURVEYS OF MICHIGAN AND MISSOURI

In the autumn of this year—1869—I entered through marriage into a new life that has lasted through forty-five years—a relation of happiness clouded only by the death of two children.

We settled in Cambridge, and during the winter of 1869-70 I lectured at Harvard on ore deposits to three students—William Morris Davis, Henry Gannett, and Archibald Marvin.

The Government of Michigan asked Major Brooks and me to make jointly a geological survey of the state. Brooks took the iron district, and I the copper region of the upper peninsula. Major Brooks had already brilliantly worked out the geology of the whole Marquette district, so I turned over to him all the notes of my explorations in the other parts of the upper peninsula to use as clues.

Several years earlier Foster, and especially Whitney, had outlined and, with some detail, described the copper region.

Lake Superior is partly divided into an eastern and western half by the long Keweenaw peninsula consisting of lava beds dipping gently towards and under the lake at an angle of about thirty-three degrees more or less. Interstratified in them are beds of porphyry conglomerates, breccia, and sandstones. The lava-flows vary in thickness from twenty to one hundred or more feet, and are usually vesicular—sometimes scoriaceous—on their upper surface. This part of the bed has generally been more or less altered, and the vesicles filled with mineral products of alteration.

It is chiefly in these vesicles—so-called amygdoloidal parts of the beds—that the copper occurs with the mineral products of altera-

tion. It also occurs frequently in the interstices in the conglomerates. It is found, too, in vertical fissure veins that cross the formation, where it has been mined in great sheets, as already stated.

I decided to confine my work to two subjects of study. One of these included numerous cross-sections by trenches along the known copper-bearing zone, carefully describing and measuring each bed, and connecting all by a transit survey. This was to try to correlate the beds of the different trenches and cross-sections along the range.

The other was to try to throw light on the origin of the copper, by a study of its relation to the alteration products, and to the inclosing rock, both chemically and in point of sequence.

While the first of these was to be of use in future explorations, the second was chiefly intended as a scientific study. The cross-sections have, I believe, been of some use. The study of the relation of copper to its associate minerals led me to the idea that it had been leached by atmospheric waters from the rock, and precipitated by iron, and this view was accepted by many. This now seems not likely as far as a downward circulation of water is concerned, for no evidence of present water or former presence of atmospheric water is found in the lower levels of the Calumet and Hecla Mine—several thousand feet below the surface. On the contrary, there occur cavities filled with a liquid of a probably deep-seated origin. More powerfully acting fluids or gases from below would doubtless, better than downward leaching, explain certain occurrences. In the Calumet conglomerate I have seen cobbles of porphyry in all stages of change to solid copper, still inclosing the feldspar and quartz of the porphyry. The compact matrix was first changed to a chloritic mass, and this replaced wholly by copper. I observed that the great sheets of copper in the fissure veins had been formed by the same process, the iron in the chlorite being the reacting agent.

In the winter of 1869-70 I had finished the manuscript of "Across America and Asia" and, with the help of my wife, had prepared it for publication. My friend and former schoolmate, Henry Holt, considered the question of bringing it out. However, the Appletons discouraged the venture, saying there was then small chance of success for books of travel. So I turned to the Harpers. When after sometime,

at their request, I called at their office, Mr. Harper said they would like to publish the book, but would not be able to do so until after several months and would wish to bring it out in a cheap edition. When I objected that my plans made it necessary for me to get quickly through with the proofreading, and that I had too many illustrations for a cheap form, Mr. Harper very kindly said:

"Think it over." Then handing me a paper he added, "I am doing an unusual thing. This is the very complimentary opinion of our best reader. Show it with your manuscript to other publishers and if you don't succeed come back to us."

I insert the "opinion" so courteously offered me by Mr. Harper. It bore no signature.

"Pumpelly's Tour round the World. A record of travel from the western terminus of the Missouri Railroad overland to San Francisco, thence to the Sandwich Islands, Japan, Russian Asia, and home to New York, by way of Paris. It consists of a copious and minute journal of adventure, exciting scenes and incidents, and geographical, historical and mercantile descriptions. The style is animated, though not in the least sensational, but on the whole rather more lively than Bayard Taylor. The information is abundant and apparently exact. Much of it is novel and all interesting. The author is a man of quick observation and sound reflection. His work is a large and important one, and will take the place of a standard book of travels. It might perhaps be more attractive to general readers if it were somewhat reduced in size, but its completeness would be impaired by any curtailment, but though long and costly it can scarcely fail of success."

Holt was captured and the book appeared in 1870, and went through at least nine editions. It has long been out of print, but, I am happy to be able to say, not out of memory; for even until now (1916) people who were then young or middle aged often introduce themselves on the strength of having enjoyed reading it. Some recall the adventures in Arizona, some the episodes in China or Japan,

while my romantic ride through Siberia especially attracted others. When I met Baron Kaneko a few years ago he said he had read *Across America and Asia* when he was young, and he now realized the correctness of my forecast of the future of China and Japan as given at the end.

It was only by a chance remark in conversation that I found out who wrote the "reader's opinion" that Mr. Harper had given me. Before the book appeared I met Mr. George Ripley at a reception. In referring to my travels he said:

"You began your journey from Jefferson City in Missouri didn't you?"

"Yes," I answered, "and now I know whom I have to thank for the very kind 'reader's opinion' of my narrative."

Mr. Ripley smiled.

I had as assistants Archibald Marvin, my former student, and Luther Emerson, who did the surveying. The results of the surveys and description of the beds of the copper-bearing zone were published in volume I of the State Geological Survey in 1873. Those relating to the occurrence of copper appeared later.

I had confined my work to the two subjects mentioned, because they could be carried through in one season, and the small annual appropriation was not sufficient to accomplish much in a general survey of the densely forested country, while it could be used to good advantage if, after the first year, the whole were given to Major Brooks for work in the iron region.

Late in autumn, a few days before leaving, I was on crutches. In cutting out a transit line I undertook to show the axeman how to cut a sapling. The double-faced axe was new to me, and at my first stroke the thing flopped over and cut deep into my instep, sending up a veritable fountain of blood. Fortunately I was able to direct the stopping of the flow by twisting a bandage, and there were enough men to

carry me four miles through the woods to the wagon, and get me to a surgeon. Near the wagon were several miners' houses. We were soon surrounded by Irish women, whose sympathy showed itself in a loud wailing that reminded me of the Corsican *lamento* over a victim of the *vendetta*.

During the winter of 1870-71 we boarded in Cambridge. Toward the end of the college year something happened that changed the course of our life. Some students who had a grudge against the two very estimable ladies who kept the house exploded a key of powder on the veranda. It blew in the window of the room where these ladies were sitting. My wife was in the room above, and the shock was so severe that it affected her health, and proved fatal to the child we were expecting. This, and the fact that the Boston climate disagreed with me, made me decide to discontinue lecturing. Pending the expected increase of the fund for the Sturgis-Hooper professorship, my salary was almost nominal, and it had become necessary to do outside work. So I turned to Lake Superior to capitalize the experience I had gained there.

Mr. Quincy Shaw and Mr. Alexander Agassiz agreed to my proposition that they should supply the money to buy lands, and that I should have the right to buy a quarter interest in these lands at cost. The purchases were to be confined to lands carrying pine, the iron formation, hardwood, and sandstone. Hardwood was then very valuable for furnaces making charcoal iron, and the Lake Superior brown sandstone was in great demand.

My wife wanted to go with me, and I felt that the out-of-door life might hasten her recovery. So as soon as she was able to travel we went to Marquette. I bought a bark canoe and hired a large sailboat and skipper and two Canadian voyageurs, one of them, Henri Ledouceur, with his educated Indian wife, Priscilla. These, with two tents, supplies, guns, fishing tackle, and abundant township maps, formed the

outfit. As guests, we had Mrs. Calvert Vaux and her daughter.

On a beautiful summer day we sailed out of Marquette harbor. As far as Portage Lake the south shore is formed by cliffs of the brown sandstone, some of which I hoped to find worth taking. Two weeks or more were spent in exploring this shore, and canoeing up the streams. The scenery was of unending charm. The many-colored cliffs of the indented coastline were overhung by a luxuriant growth of primeval forest, and the entering streams were outlets of chains of lakes nestling in wild scenery, and abounding in trout or pickerel and ducks. There were beavers, partridges, and porcupines; and now and then a deer. However, we took of these only for food fish, ducks, and partridges. The spruce-partridge is a stupid bird. He would wait patiently while we made a pole with a noose to pull him down. Those were delightful camping experiences in that bracing air under the northern stars. The flickering light of the campfire penetrated mysterious recesses in the dark forest. The silence was broken only by the hooting of an owl or the long, uncanny cry of a loon.

Late on one afternoon the sky showed menace of a sudden storm that left us barely time to reach the lee side of a nearby island and to get ashore, when the elements broke loose. The island was a mass of flat-lying strata of quartzite. Large broken masses of this rock forming the surface were covered by a thick growth of moss, out of which grew a dense forest of spruce. Everywhere the moss-covered pitfalls threatened broken legs or worse. Our fire ignited the moss hanging from a spruce. Instantly the flames shot upward. Only the drenching rain saved us from the terrors of a burning forest.

The wind god of the lake celebrates when the sun god leaves the Northern house. On the wings of the storm he lays low the forest. Catching up a spark, he turns to ashes whole town-

ships—woods, villages, people. Burning treetops fly ahead through the air to cut off escape.

Two days long the clouds flew by above us, and the wind howled through the forest, but we were safe except for falling trees and the pitfalls.

I think it was in this storm that the steamer *Huron* went down with all on board. Some of our friends were on it, including Professor Hodges.

Mrs. Calvert Vaux and her daughter turned homeward at Houghton.

Sometime in October we reached Bayfield in Wisconsin, where there was a U. S. Land Office. I had two reasons for going there. One was to look for pine lands, the other was to outfit for a visit to the lands I had taken for the Canal Company when we were made to shift a part of the first grant. I wanted to see whether my assumed iron range really existed and whether the even numbered sections were promising.

As it was important to keep the object of the exploration secret, I drew a line on a map for a trail parallel to the supposed iron range, but about a mile distant. It extended about thirty miles to Lake Gogebic. Along this I sent a party of Indians under a head packer to make *caches* of provisions at specified points, and make a quick return. Major Brooks was to meet me at the Montreal River, and we were to study the route together, with only two packers who could keep us supplied from the *caches*.

In the meantime there appeared a man offering to sell the notes of several thousand acres of pine land. An examination of the land office records showed the lands to be open for entry. These I bought after some random test examinations.

A sail across the bay brought us to the mouth of the Montreal River. It was my intention to take my wife to the point where we should meet Major Brooks, and begin

our exploration, and to leave her there in a stationary camp with the Indian woman Priscilla and her husband. As she was not yet strong enough to make the journey through the woods on foot, Indians were engaged to carry her in a hammock swung on a pole.

Around their campfire, that lighted up the dark recesses of the forest, these Indians were a picturesque group. Their leader wore a decorative name. We liked the sound of it so much that it caused him more than his share of work. It was *Jin-go-ben-e-sic*—War Eagle.

Henri and Priscilla made a delightful stationary camp in a stately forest and near the river. In a large tent, with one side open to the air, they made a thick, soft bed of carefully thatched hemlock boughs, and arranged all the possible conveniences for a prolonged stay. Their own tent was put up close by the large one. There were abundant provisions, and Henri was an expert in getting game and trout. As both Henri and Priscilla were devotedly attached to my wife, I felt that I was leaving her under health-bringing and happy conditions, for she loved the primeval forest in all its aspects.

During the previous winter I had read Whittlesey's account of the occurrence of magnetic ores in northern Wisconsin, which seemed to be possibly a continuation of the formation we were to look for in Michigan. So we had agreed that Brooks should begin on the Wisconsin side and try to trace the formation to our meeting point near the state line.

We decided first to try to trace the iron formation through to Lake Gogebic, about thirty miles distant, and then to examine it more carefully on the way back. It took us more than two weeks to trace it to the point where we lost it west of Lake Gogebic. What we saw was very discouraging. There really was a continuous iron formation resting on quartzite, and this on granite, but it was totally unlike

any that we had seen. The few outcroppings showed only ferruginous slates or in places bands of highly siliceous magnetic ore.

By the time we were ready to return a foot of snow had fallen, making hopeless any further examination. So we parted, Major Brooks intending to go eastward after studying the relation of the Cambrian sandstone to the Keweenaw trap rocks, while I started back on the trail made for the *caches.*

One morning, as we reached the top of a high hill, Jingobenesic startled me. He pointed to the southeast. Far away above the forest there stood a wall of dense smoke. It rose high in the sky, and stretched along many degrees of the horizon. It clearly meant an overwhelming conflagration—one that threatened destruction to everything in its course. We could not judge of its distance, but I thought of my dear wife in the heart of that vast forest, and twenty miles from the lake and safety, and it would take us nearly two days to reach her camp!

While I was hurrying forward in this anxiety, we met a messenger bringing a telegram and letters. He had been sent on from the stationary camp, and brought news of the great forest fire in Oconto County, Wisconsin, that was destroying whole villages and their inhabitants. The fact that it was more than 200 miles off and to leeward relieved my anxiety. Early in the morning, before reaching the Montreal River, I left the blazed trail, and climbed a high hill to look towards the wall of smoke. The hill was on the quartzite of the iron formation. It commanded a grand view over the great forest that, extending around Lake Superior, stretched away to the north, to gradually dwindle to the stunted vegetation of the Arctic zone.

I sat long trying to solve a problem of duty. The telegram I had received the day before was from Messrs. Lee, Higginson

and Company. My large purchase of pine land was not approved; they did not want to accept my draft. I had wired back, by the messenger, that objections came too late, but I was left in a dilemma; for, notwithstanding the unfavorable appearance of the iron formation, I was intending to take up the even numbered sections in accordance with the policy I had followed in locating tracts on iron formation for the Canal Company. I now felt that I should be criticized for buying a large amount of iron land of which I could not speak with more confidence than I could show in the case of a formation so different from any known on Lake Superior.

While thus thinking I noticed numerous yellow stains of limonite in the rock. What is luck? Those yellow spots! They determined my fortune. I knew they probably had no important significance, but there was a remote possibility that they meant concentration of iron oxides in the overlying formation. I decided to take, for the pool at least, this tract, about two miles long.

I found the stationary camp abandoned. It had been left at least two days or more.

We followed a well-marked trail made in the snow by the party in moving towards the mouth of the Montreal River. It was after midnight when we reached the lake and found the camp.

In the bracing air, and under the devoted care of her attendants, my dear wife had recovered her strength. Priscilla had enlivened the time by telling Indian legends and tales of the wars between her people and the Eskimos, for she came from the North, and she had taught her mistress how to make and embroider moccasins. A hammock-stretcher was no longer needed; in spite of the snow, the trip out was made on foot.

At Bayfield I found a letter from Agassiz objecting strongly to the purchase of iron lands.

We took passage on a propellor to Marquette. It was the last trip for the season, and the boat was crowded with quarrymen, nearly all of them drunk.

Soon after leaving these men became so uncontrollable as to produce a serious situation, for they were overcoming the crew. The captain got out the hose and was beginning to play it on them when, on emerging from among the Apostle Islands, we came into a choppy sea. This quickly settled matters by leaving the floors covered with very unsettled victims.

And now came on a furious storm that placed us in danger of adding to the list of wrecks on that rocky coast. We even could not enter Eagle Harbor—the only place of refuge. No sea-craft could equal the old-time propellor for a training in seasickness.

At the land office in Marquette I again faced the problem that had sorely troubled me on the quartzite ridge in the woods. On the books the even numbered sections were all open for entry. From my notes I could cover all the iron formation along twenty miles of even sections. Under ordinary circumstances I would, without hesitation, have taken the risk. However, since that telegram about pine lands, and Agassiz's letter, seemed to show lack of confidence in my judgment, I preferred not to invest in lands on an iron range of which I could not speak with some confidence. As I shall show, I missed the opportunity of a lifetime. I was, of course, debarred from buying with my own money. Still I bought, on the joint account, two miles of the range adjoining the quartzite ridge. Those two miles now form the Newport and Geneva mining properties. They have produced till now (1915) 12,000,000 tons of ore.

Two or three years later a miner by the name of Moore, thrown out of work by the panic of 1873, was employed in looking for pine. There wasn't any pine land in the region.

He sat down to smoke and curse his luck on a hill several miles east of the land I had taken. At his side rose the upturned roots of a great tree that had been felled by a recent storm. Where its roots had been there was exposed a smooth surface of black rock. Lifting a piece, Moore found it very heavy, and, being a miner, he knew it was not ordinary rock, though he had never seen anything like it, so he put it in his pocket as a curiosity. An assayer found that it was a very pure bessemer iron ore. Moore raised money to buy the tract, which became the Colby mine, and long before I heard of the find all the even sections, excepting my purchase, were taken up. Thus was started the great Gogebic iron range. Every section along it is dotted with mines which, together, have produced, up to 1915, over eighty million tons of bessemer ore.

However, there was no attempt to prove the range for several years. Under an option for a lease the Cambria Iron Company explored the land I had bought, and rejected it. In the meantime, as there had not yet arisen any demand for the pine on our lands, Mr. Alexander Agassiz became tired of the investment, and authorized me to sell their three-quarter's interest in all the lands for an amount which would give them a large profit. This included my payment for one-quarter interest.

Some friends joined me in the purchase.

In the autumn of 1871 I was offered the position of State Geologist of Missouri. I had been led to expect political interference from the Governor, then Gratz Brown, and from the Legislature. Instead of this I had only cordial support.

The stratigraphic geology and paleontology of the state had already been well established, considering the condition of these subjects at that period. Therefore I organized with reference to special study of its mineral resources.

For assistants I chose Mr. Broadhead for the coals, Dr.

Adolf Schmidt for the ores, and Messrs. Regis Chauvenet and Andrew A. Blair as chemists.

After a reconnaissance of the iron ore localities I settled down to study personally the geology of the iron ores of the porphyry region of eastern Missouri.

In the winter of 1872-73 a severe enteric disease and an attack of meningitis so affected my health that I resigned and removed to Balmville, four miles north of Newburgh, N. Y., to prepare the results of the survey for the volume that appeared in 1873.

In all directions the work of the survey had been both interesting and economically important. It included a careful examination of all the deposits of iron ores at various ages and kinds, as well as of the ores of other metals. Also a good beginning was made in the survey of the coal fields.

The work was ably continued by my successor, Mr. Broadhead, along the line I had adopted. In undertaking the work I had intended to remain only long enough to study chiefly the geology and distribution of the iron ores of the state and to prepare the way for a systematic survey of the other economic mineral resources.

On my trips I found the farmers always hospitable and generally, too, interested in the survey. They had one custom I had not seen elsewhere. There was almost always a basket of turnips at hand, from which you were expected to take at least one and eat it raw.

On my trips in the winters I suffered far more from cold than anywhere before or since. I remember a Thanksgiving dinner at a hotel in Fredericksburg where all the guests seemed to think it quite natural to have no fire in a room in which the mercury stood below zero Fahrenheit.

CHAPTER XLIII

WRITING, RESEARCH, AND FARMING

THE old Potts place which we rented at Balmville had twenty or thirty acres of lowland and hill and gardens, all in a charming condition of neglect. The house was in keeping with it all. It dated probably from the seventeenth century. In the large parlor the paper was falling from the walls. In starting to repaper an old paper appeared, and before we finished we had peeled off, one after another, six layers of older and older designs. The bare wall was a revelation. Our parlor had been a seventeenth century barroom. On one wall were scored the tallies of drinks owed by patrons now long extinct. The other walls were covered with charcoal sketches of Dutchmen of two centuries agone, and of quaint ships sailing on the river. I've always been sorry that we didn't leave the walls bare.

We were welcomed by many dear friends of my wife on both sides of the river. Among these were our near neighbors, Mr. Henry K. Brown, the sculptor, and his wife. Mr. Brown was then finishing his statue of General Scott. The horse had served in the war, and had been Morgan's "Black Bess." I remember that she showed her intelligence by using the slack of her halter as a loop to pull in food set beyond her reach on a flat place facing the manger.

Mr. Brown was one of the most agreeable of men. He was also one of the most absent-minded. One day two distinguished French artists brought to him letters of introduction, and were asked to come the next noon to dinner. They came early to the studio. After half an hour of talk Mr. Brown,

saying that he had to go to dinner and expressing his great pleasure at meeting them, and hoping to see them again, bowed his visitors out of the door. When Mrs. Brown asked where were the expected guests, they were beyond recall.

Mr. Brown made his friends pose for details in his modeling. I sat for a few minutes on "Black Bess." The posing of his friend, Mr. Jenkins, was responsible for the amplitude of the trousers on Brown's statue of Lincoln.

There was among my local friends a gentleman who, perhaps, thought I might be got to church by asking me to take a class in the Sunday School. I replied that doubtless some of the class would be less likely to remember moral lessons from me than language used in getting them out of my cherry trees, and all the more so because it was uttered good naturedly.

"Oh! don't let that trouble you," he answered. "Of course I don't approve of swearing, but I know it is often a relief; very good men sometimes give way. I once heard the Rev. Mr. ——, rector of Grace Church, who was alone in his garden adjoining mine, relieving his feelings by most shocking language."

As soon as I had seen through the press my report of the Missouri Geological Survey I turned to more congenial work. I wanted to trace the relation of the occurrence of native copper in the trap rocks of Michigan to its mineral associates, and their relative ages. I had in 1871 published the results of a study in paragenesis, in which the relative age of two minerals is shown by the growth of one upon an already perfected crystal of a different mineral; and of pseudomorphism, in which one mineral has been replaced by another which retains the form of the original one.*

For most of the work I had to cut from rocks, for study

* "The Paragenesis and Derivation of Copper and its Associates on Lake Superior," *American Journal of Science*, November, 1871.

under a microscope, sections thinner than the thinnest tissue paper—it was a method just introduced in Germany. This study occupied my time during the three years we lived at Balmville.

The machine I used stood in a room over the kitchen. In the same room stood a large water-tank supported a few inches above the floor. Beneath the tank our maltese cat had a family of kittens. From where I sat I could see down the stairs to where, at the bottom, a door at the side opened into the kitchen. This door was closed by an old-fashioned latch, and was always kept shut by the wind. The cat had solved the problem of opening the door against the draft. Standing below she rose on her hind feet and with one paw pulled down the latch, pushed the door open with the other, and jumped through before the draft could shut her in.

After being disturbed by a maid the cat transferred her family to a hole in a stone wall far from the house. One day, when I was standing in the cellar, the cat, holding a kitten in her mouth, came down the steps from out-of-doors, and, laying her little one at my feet, rubbed against my leg, looking up to me the while as though appealing for help. The kitten had just died.

Here is a dog story. Among the belongings of the place were an old shepherd dog named Bruce and a Spitz. They were devoted to each other, but the Spitz was so intensely jealous of any affection shown to the other that he would dance with rage and bark furiously until we petted him. One day Bruce was missing, and for nearly three days could not be found. In the afternoon of the third day my wife, my secretary, and I were sitting on the veranda that faced away from the street. Suddenly the Spitz came on the driveway around the house. He was walking slowly, looking behind and barking. After catching our attention he went back out of sight and returned still barking. At last the

shepherd dog appeared behind his herald, and, with his head down, hobbled painfully to where I stood at the foot of the steps. He had been in a rough fight, and had a big raw sore on his right shoulder. After washing the place I put on oil and carbolic acid. For a long time, while we were petting Bruce, the Spitz stood patiently by, but he gradually got restive, and then furious, when he found that there was no sign of affection for himself; when that failed, that dog drew up his right leg, hung down his head, and dejectedly hobbled around, all the time watching us. I needn't say how much petting he then received.

Forty years later I saw this same performance duplicated by other dogs. My Gregg grandchildren were with their aunt, Miss Marjory Gregg, at one of the cottages on my place. A fierce fight occurred between their collie—Sandy—and the dog of a visitor. In vain each of the ladies pulled at the tails of their dogs, who were separated only by liberal applications of cold water. That evening my daughter Elise's little Cocker spaniel seemed unusually interested in scenting my shoes. She kept returning to the problem. Doubtless she recognized the scent of Sandy, and was puzzled by that of a stranger. The next morning she followed me to the cottage, and quickly took the trail to where the fight had been, and then ran back toward the house; then seeing Sandy come out hobbling on three legs, with the left foot held up, she held up her leg and hobbled toward him.

Regularly before breakfast, with our little daughter Margarita in my lap, I rode around the Balmville place. Its limited area was enough varied in character to be always charming. There were the lakelet and stately trees and, best of all, from the hill a grand view down the Hudson to Storm King where the river breaks through the mountain. On this hill my wife was wont to drive with the two-year-old child; and one winter, when the hill was covered with a

glare of ice, the cart capsized, dislocating the mother's elbow. An obstinate surgeon treated the injury as a fracture until, too late, the real nature of the case was discovered, and thenceforth through life the elbow remained rigid and useless.

In the May after this accident Elise was born. In the autumn we decided to move to Boston, still hoping to find some treatment whereby her mother might regain the use of her elbow.

There was one of my horses that I did not care to take with us. He was sound but getting old. The man who supplied us with butter came asking to buy the animal, and, after examining him, offered a fairly reasonable price. I liked the man, and knew that he was having a hard time, and that the horse would be well treated. So I said: "Mr. B——, I want the horse to have a good home, and because I know you will treat him well I will give him to you without pay. He is perfectly sound, and should give you good service for a long time." That man was suddenly convinced that some hidden and terrible disease in the horse made me anxious to get it off from the place. He stammered some excuse and refused to take it.

In the autumn of 1875 we settled in Boston for the winter, living first at the St. James Hotel, and later at the Norfolk House in Roxbury. I'm going now to bore the smoker and please the other fellow with an account of my experience in giving up tobacco. I was under contract to Henry Holt to write a text-book of geology. Alexander Agassiz gave me the use of a room in the Museum, where I made all the preparations for a season of agreeable work. Alas! I had not counted on an unknown factor. I had arrived in Boston with a cold in the head that for several days made smoking uncomfortable. When the cold was over, I said: "I won't smoke until to-morrow," and continued to put it off so often

that I decided to give up tobacco altogether. That decision killed the text-book.

Through all the winter, in rain and sunshine, snow and ice, I rode my horse daily to Cambridge. On the way I was always full of what I wanted to say, but when I got back I sat for hours unable to formulate my ideas. I could cut thin sections, draw them under the microscope, and make notes. But I could not make a logical statement of the subjects in my mind. Each evening I rode back, sure that the next day I should be able to do better. The winter passed with only a few pages of manuscript to show. It's possible that the fact that smoking was not allowed in the Museum helped in keeping me to my decision. However, what I did with the microscope was of real use. Within a year my memory and mental grasp were far better than during the twenty-two years of hard smoking that began in the malarial region of Corsica. I had never intended to stop more than temporarily, but it was nearly fifteen years before I began again. To me the moral is that the use of tobacco is a serious handicap to a young man in the intense competition of to-day, and is best left until much later in life.

I remember one memorable event of the winter 1875-76 at a meeting of the American Academy. Mr. Charles Francis Adams presided, and Mr. Graham Bell exhibited his telephone. It was the first time that the invention had come out of the secrecy of the laboratory. The instrument was connected by wire with another room in some distant part of the city. In turn we all listened. Music was heard very clearly, but the transmission of the voice was quite imperfect. A few months later, at the Philadelphia Exposition, the difficulty in transmitting the voice had been overcome.

I went to this exposition chiefly to see the objects of Japanese and Chinese art. The only sleeping place the hotel could get for me was in a private house. The room was

only large enough for a bed five feet long, with the foot at the window and the mattress on a level with the window-sill. I woke up while it was still dark with my feet out of the house, uncovered and burning with mosquito bites. Rain was just beginning to bathe them, so I left them there, and under this soothing influence struggled through the rest of the night.

The Japanese exhibit was disappointing. At first I could not tell why, till I examined closely the great display of large modern bronze vases. They retained good traditional forms, but were incrusted with copies of the small metal ornaments —*kanemono*—made for clasps on tobacco pouches. The decoration on these, while highly artistic, was minute, and meant to be seen at close range. They spoiled the outlines of large vases intended to be seen at some distance. The attendant whom I asked for information told me that at the Vienna Exhibition the Germans had advised the Japanese to do this. In answer to my asking what he thought of it, he led me to a small case, and took from it some old things over which he affectionately passed his hand. "Only these are what we like," he said. The West had already begun to commercialize Japanese art. That of China remained still untouched.

In 1876 we moved to Owego to be with my father and mother who were getting old. My brother was engineering in the far West and my sister living in Europe.

During the first summer I began to feel relief from the effects of leaving off smoking. I was able to review books of travel sent me by the *Nation*. Later in the year my memory had improved so much that, by making full notes as I read, I reviewed Richthofen's *China*, sent to me by him for that purpose, and King's third volume of the *Geological Survey of the Fortieth Parallel*.

In the autumn of 1876 my dear father died, eighty-nine years old. He who had always lived an abstemious life—he

rarely had wine on the table and never used tobacco—was in broken health through his later years.*

I took great interest in reviewing Richthofen's work. I had heard that he considered wind-transportation to have been the means of the vast distribution of loess.† I had found fresh-water shells in loess at several points along the Great Wall, and had described it as a sedimentary deposit of glacier mud left by the Yellow River in a chain of former lakes. I had been rather proud of my hypothesis, but Richthofen had seen the loess over a vastly greater area than I had, even covering mountains 5,000 feet above the sea, and abounding in land shells everywhere excepting where, as I had seen it, streams had redeposited it with fresh-water shells.

I realized that Richthofen's assertion of wind origin was unassailable, and I took pleasure in agreeing with it. But the source from which he thought the dust came seemed insufficient for the vast amount to be accounted for.

Because of its vast extent over the northern half of China, its great fertility, and the self-sufficiency of its fertilizing capacity, it is the fundamental environmental factor of the civilization of China, and, therefore, of nearly one-third of the population of the earth.

These facts possess a world-wide interest, for while the

* His brother Harmon, who had always lived generously, died also at 89 a hale and hearty man a day or two after his last ride on horseback. Inheritance was the dominating factor in their longevity, for their father died at 92 and their mother at 76.

† Loess is a soil of almost microscopically fine texture brought by winds and finding rest in the grasses of semi-arid regions. Under this protection of the grass, which in turn it nourishes, it has slowly accumulated till in northern China it has covered much of the country to a depth of hundreds of feet. It is extremely porous and in the undisturbed loess the decay of the stems of the grasses has often left a vertically tubular structure which causes cliffs to permanently retain a vertical face although it crumbles to fine powder in the hand. The dust contains the salts of the rocks from which it was derived and, according to Richthofen, in rainy seasons the capillary tubes bring these salts to the surface to fertilize the soil. The firmness of loess is shown by the fact that communities live in comfortable apartments carved in cliffs.

population of the world is rapidly increasing the natural productivity of the soil is decreasing, and productivity can be restored and maintained only by continued use of costly fertilizing agents—phosphorus, nitrogen, and potash. In the economic struggle of the future, advantage will therefore be with the peoples whose agriculture is favored by the possession of permanently self-fertilizing soil. Such soil exists in varied extent on all the continents, but to a far greater extent in China; it has there maintained its natural productivity during more than two thousand years. And it is there to feed a people who possess potentially half or two-thirds of the industrial energy of the world.

Richthofen traced loess backward to the crumbling of desert rocks under changes of temperature, and to wind erosion of soft desert formations.

This led me to consider the problem of the probable causes of reduction of rocks to siliceous powder of a finer grain—like loess—than is possible by water erosion. The result of this thinking, based largely on my observations, I published in the *American Journal of Science.** My argument was:

1st. That during long ages of normally moist climate the rocks of a region become disintegrated and decomposed often to great depths. This is evident in all regions that have not been denuded by glacial action.

2d. That any climatic change that permanently destroys the vegetation leaves the disintegrated mass a prey to forces of transportation.

3d. Through a climatic change causing a glacial period there would come the removal of the altered rock-mass in all the forms of glacial débris—boulders, gravel, clay, and glacial flour which is the product of the grinding of débris and rock bed under the moving ice. This material is in part

* The Relation of Secular Rock—Disintegration to Loess, Glacial Drift and Rock Basins. *American Journal of Science*, Vol. XVII, February, 1879.

left by the retreating glacier as moraine and glacial drift or "till"; and, in part, is carried as coarser or finer débris by streams to be spread over the lowlands or carried to the sea. The downward disintegration acting on rocks of different power of resistence would leave an abnormally irregular topography of the solid rock surface in which depressions scoured out by the loaded ice would remain rock basins.

4th. If the change is to aridity the region becomes a desert, vegetation disappears and the disintegrated rock-mass becomes prey of the winds.

In Asia the products of glacier work were spread out to dry on the flood plains of rivers emerging onto the deserts.

Thus water had played an intermediate part in the origin of a portion of the loess. But the final stage of its transportation was, as shown by Richthofen, by the winds that sifted it out from the sands and carried it beyond the bare desert to find a rest in the grass that protected it and which it nourished.

Richthofen accepted my view and published it with credit in his second volume. In Sweden, Nathorst wrote an article on "Pumpelly's Theory" to show how it explained several obscure points in Scandinavian geology.

Having trained Herman Ohm, a young lapidary, to cut thin sections of rocks and minerals, I was able to finish my studies on the copper-bearing rocks of Lake Superior. In examining thin sections under the microscope it is very important to be able to identify the different feldspars. Up to that time there had been no means of doing this. When crystals are cut in planes having proper relation to the optical axes, the species is determinable by the angles of extinction under the polariscope. But in thin sections of rocks where the crystals are minute they are, of course, cut without regard to such relation. By making many sections of all the feldspars, and determining for each species the range of extinction in all

positions in the zone O:ii, I got a simple method of quick indentification of the microscopic crystals in thin sections. This was in 1877—several years, I think, before Michel Levy introduced his similar but more precise method.

As a result of this study I was able to present the ancestral trees of the different secondary minerals back to the first change of the original matrix into prehnite, and to show therein the relative position of copper.*

There was one of my father's farms that was beautifully placed several miles down the river. It was evidently intended for a dairy. I felt that to make of it a successful dairy farm was my mission. My brother agreed; my wife, with a woman's intuition, knew better.

I built a sanitary barn and milk-house, and bought some registered Jerseys, and imported a Guernsey cow. To have an extra Jersey bull growing up, I visited the herd of the secretary of the Jersey Association on the Hudson. The secretary was away, but his wife showed me the herd. After I bought Tigerlily, a beautiful bull calf, Mrs. H—— showed me his grandmother, Lady Mary—the prize cow. The "prize" was skin and bones and coughing badly. Mrs. H—— answered my remarks on the cow's appearance: "I tell Mr. H—— that the cow is too thin and is sick, but he says it's better that the food should go to make milk rather than to flesh. Within a month Lady Mary's pretty grandson died of tuberculosis.

One day our farmer said that we badly needed some pigs. He added that I might look up some on my horseback rides. He knew of one man who had some, but that man "wasn't honest," and would "skin" me in the trade. When I rode up to that man he really did look sharp.

I said: "I'm looking for some pigs."

* "Metasomatic Development of the Copper-bearing Rocks of Lake Superior." Proceedings of the American Academy of Arts and Sciences. Vol. XIII, January 9, 1878.

He sized me up. "Well I've got just what you want if you're after the very best."

He showed some pigs in a pen. All I could infer from the sight was that they were pigs, and very dirty.

"There! what do you think of them?" he said. I laughed.

"Mr. B——, I know absolutely nothing about pigs. I've despised them ever since one ate up my hat when I was an infant."

"Well," he said, "those pigs are worth six dollars a head if you take the lot."

"Mr. B——," I answered, "I haven't the slightest idea of the price of pigs. I suppose these are valuable ones because you say so. You see I'm at your mercy. If you say six dollars is the proper price I'll pay you now and send later for the pigs."

The man seemed disturbed. "I don't like to do business that way," he answered.

"Well that's my way as man to man," I answered, taking out my money. The owner was silent and uneasy, as I counted out the bills, then suddenly: "See here, stranger, you may have them pigs for three dollars a head."

When I next saw our farmer he said:

"You got a prize lot of pigs. I bet B—— stuck you for five or six dollars a head. They're really worth about four."

I had expected to rapidly breed a dairy herd for the farm. Unfortunately the Guernsey, having arrived with a broken hip, couldn't breed, and the Jerseys all dropped bull calves.

When I found that our honest farmer owned a farm nearby and carted thither all the manure from ours, I sold out land and stock.

In Owego there were born to us Pauline, and later a beautiful boy who lived only three months.

During the years at Owego I made professional trips to California and Maine. In Maine I saw an effect of lightning

that is worth recording. A small house where I lunched in Sullivan had been struck a few months before my visit. It was a small two-story house with a narrow one-story kitchen extension in the rear. The lightning had torn through the kitchen roof a hole more than a foot square, judging from the new shingling. The electricity had struck and followed a spike that fastened a rafter to the main house, and, leaving the point of the spike, had made a half-inch hole through the plaster into the sitting room. I saw this hole just under the ceiling. The design on the wallpaper of this room contained continuous lines of gilt or "bronze gilt." The electricity had left its blackened track along the sinuous course of only one line down one wall and up another to where the line was pierced by the iron fastening of the bell wire. This wire it doubtless followed to the knob at the front door, where the rain had established ground connection.

CHAPTER XLIV

TENTH U. S. CENSUS AND NATIONAL BOARD OF HEALTH

EARLY in 1879 Clarence King, having been appointed director of the United States Geological Survey, offered me my choice of position and field. Before the field was determined it was decided to turn the census of mineral industries over to the Geological Survey, and General Walker and King asked me to take charge of this department, exclusive of the precious metals and mineral oils.

I got permission to have my place of official residence and offices at Newport.

Having a free hand, I decided to lay special emphasis on the iron ores as underlying the fundamental industry of civilization. The census of the other minerals could be confined largely to the usual statistical methods. My plan was to have every mine and every known outcrop of iron ore, from Canada to the Gulf of Mexico and from the Atlantic to the Pacific, examined geologically, and systematically sampled for chemical analysis.

For assistants I chose Andrew Blair for chemist and disbursing officer. His assistant chemists were F. A. Gooch, J. Pitman, J. F. White, Edward Whitfield, W. T. Richmond, C. F. King.

The examination of the iron ore deposits and collecting of samples was intrusted to Bailey Willis, Bayard T. Putnam, and E. R. Benton.

Special agents for gathering the statistics of mining industries were selected from among men of standing in their

respective districts, and analysis and planning of the tabulation of their returns was ably done by Charles F. Johnson. T. Nelson Dale conducted the voluminous correspondence connected with the schedules.

I established the laboratory and offices in the historical old Vernon House. Within two months the whole organization—personnel, instrumental equipment, and the methods, down to the special notebooks—was in order, and the assistants in the field. During two years there poured in a steady stream of iron ore samples in groups of five-pound bags, each one accompanied by description and geological diagrams of the occurrence. And they all came by mail under government penalty label for postage, causing much consternation to the postmasters of country offices, some of whom, supposing them to be precious metals, kept them guarded over night.*

The census office furnished the blanks for statistics to be collected by my force, in the field or by mail, and edited by us. An *esprit de corps* ruled throughout the whole organization.

The only trouble we had was at times in getting full answers to some of the questions on the statistical forms of the census office, which contained questions that if rightly answered would betray secrets, and which should not have been asked. Sometimes the officers of a corporation refused to answer until shown the clause stating a heavy penalty for refusing. Answers so obtained were of too doubtful value to permit of tabulation. Mr. Pardee of Pennsylvania wrote me that he hoped not to live till the next census. If I remember rightly, it was Sir John Hawkshaw who told me that the English Government would not dare to ask such searching questions regarding private affairs.

When the work ended early in 1881 we had analyzed 1,377

* Professor Charles Sargent, who had charge of the Forestry Census, even sent as mail matter a section of a California big tree long enough to require two flat cars.

samples of iron ores, determining the metallic iron, phosphorous—to three decimal points—silica and sulphur, and including a considerable number of complete analyses.

Building materials and the minor minerals were treated much less thoroughly, and the coal industry chiefly statistically.

The report, including an exhaustive discussion of the iron ore resources of the country, with about 1,000 pages and 102 plates, made up the fifteenth volume of the Tenth Census.

The assistants in the field told many humorous accounts of customs among the primitive people of the mountains of the South. After supper at one house Bailey Willis sat with the family smoking and talking before a large fire. There was only one room, and no beds. Willis wondered where they slept. There were several big logs standing against the wall. At last the host knocked the ashes from his pipe. He took down the logs. They were hollow, and were the beds.

At another house with one room all the family slept across one wide bed. On this Willis slept with the father, mother, and grown-up daughter.

On one of my trips with one of the assistants we passed a stormy night in a miner's house in the Virginia mountains. We ate supper in a room where five boys and girls down with measles lay across one bed, and another lay in a cradle that was too short. There were present also several miners.

We had passed the summer of 1879 at a cottage on a beach near Portland, Me. The death of our little boy, and serious illness of Pauline from dysentery, led me to look up the sources of the drinking water. The wells were everywhere exposed to underground pollution. It seemed that this was a widespread danger needing immediate attention. One evening, after a meeting of the National Academy of Sciences, I was smoking with a group of physicians—Weir Mitchell, John S.

Billings, H. C. Woods, and, I think, Sternberg. All of them, I think, were on the National Board of Health. I told them of my summer experience, and said there were two things that should be done to combat the spread of enteric diseases. The Board of Health should use its power to inspect the water supply of health resorts, and it should start an investigation into the extent to which different soils are able to hold back bacteria. The doctors all assented, and said the board would at once have health resorts inspected. They said that the soil investigation was a geological problem, and would also involve much laboratory work. They would bring it up at the next meeting of the Board of Health. Later the board wrote that if I would take charge of the soil investigation, they would give me a free hand. So I had two lines of work on my shoulders.

The board sent its inspectors to health resorts the following summer.

For the soil laboratory I hired a house on Mary Street in Newport, just below my census office. I also set about thinking out methods of attacking the problem. It had to do with the detecting of microörganisms in water. The science of bacteriology was then in its infancy. I knew that there was a practically ever-present organism known then as *Bacterium thermo* which visibly decomposed a beef infusion. It would simply be a question of devising the proper apparatus for sterilizing the infusion, and for bringing into contact with this the water to be tested. I wished also to test whether this organism was given off into air from sewage.

While it could not properly be assumed that in filtering through the soils all disease-bearing organisms would act like the *Bacterium thermo* it seemed right to assume that the presence of that organism in ground water meant pollution.

The means and methods were simple but demanded very careful manipulation. So I engaged a chemist—Mr. George

A. Smyth—as assistant, and it was to his skill that was largely due the success of the investigation, which lasted two years until the National Board of Health was abolished.*

Among the materials tested for their filtering capacity there were not only soils of every size of grain from the impalpably fine loess to coarse sand, there were also asbestos, charcoal, animal charcoal, coal ashes, spongy iron, and pulverized rock.

The beef infusion if left open to the air decomposed within forty-eight hours. We passed no water through the filters until the infusion had remained uninfected for weeks.

Our results were clearly defined. It was found that while closely packed asbestos, clay, and very fine animal charcoal possess a very slight filtering capacity, sand, no matter how fine, and loess, the finest of soils, presented absolutely no resistance to the passage of the infecting organism. We filled one hundred feet of lead pipe with ground quartz screened through sieves of one hundred meshes to the inch. The sand was sterilized at a white heat and the pipe at over 200° Centigrade. The first drops that passed through decomposed the infusion that had remained intact for several weeks.

On the other hand, when instead of water we passed air very slowly through the filter, we found that almost anything held back the organism of putrifaction. Used in this way a filter less than one-eighteenth inch thick, of dry sand, will for months keep uninfected the infusion beneath it.

Another long series of tests with air showed that sewer-gas is practically free from the putrifying organism. Sewage suspended eighty days in a bent tube, over beef infusion in a temperature ranging between 20° and 35° C., failed to cause decomposition. Air was slowly drawn during more than a month from over the surface of sewage, and through the sterilized infusion, without causing decomposition. How-

* My report was published in 1883 as Appendix O. of the report of the National Board of Health, pages 519 to 660.

ever, if the air was drawn fast enough to produce bubbling the infusion soon decomposed.

My report was highly commended in Europe and by the National Board of Health, which consisted of the most eminent American physicians and sanitarians of the time. I was asked to enlarge its scope, but the board was abolished by Congress.

In the winter of 1880-81 we built our house on Gibbs Avenue in Newport. It was quite logical that the building should embody my ideas of sanitation. Among others, instead of hair and ordinary sand, the plaster has Italian asbestos and ground Berkshire quartz. This was to have plaster free from decaying organic matter. The resulting walls were very hard —so hard indeed that I paid thirty dollars to have a crack cut out with a cold-chisel.

CHAPTER XLV

NORTHERN TRANSCONTINENTAL SURVEY AND THE ROCKIES

HAVING finished the census work, I resigned from the U. S. Geological Survey in 1881, to organize and direct a survey after my own heart.

Toward the end of June, 1881, Mr. Henry Villard wrote asking me to call on him. He had just succeeded with his famous "blind pool," and had organized the Oregon Transcontinental Railway system, including the Northern Pacific R. R. and the Oregon Railway and Navigation Company.

When he found that I was open to an engagement, he said to me about as follows:

"Mr. Pumpelly, we are building a system of railroads through a vast region of which we know very little. It is of vital importance to learn about its resources and their distribution to guide us in building feeding lines. There should be made a survey with this idea in view. If you can undertake this, please draft a plan for me to consider."

I took only two or three days to outline the scope of the survey. The system of railways was to serve an area of more than 400,000 square miles—more than twice as large as the German Empire. Of this the Northern Pacific R. R. alone, through its land grant, owned 70,000 square miles—470,000,000 acres.

Prospectors had shown a wide distribution of mineral wealth, and there were rumors of bituminous coals. At the moist Pacific end were the finest forests in the world. On the semiarid plains traversed by great rivers cattle and sheep

were displacing the buffalo, and doubtless the abundance of water would make irrigation possible over great areas.

After receiving a sketch of my plan for the survey Mr. Villard wrote as follows:

New York, June 30, 1881.

Prof. Raphael Pumpelly,
Newport, R. I.

Dear Sir:

I request you to organize a force for the exploration of the mineral and agricultural resources of the territory, contiguous to the lines of the Northern Pacific Railroad, and the Oregon Railway and Navigation Co. in such manner as you may think fit, to begin, from the 1st of July. It is understood that the salaries and laboratory expenses, exclusive of your salary, will be for the first year not more than $30,000, unless I choose to increase the amount. Your salary to be $10,000, exclusive of all expenses. You may keep your headquarters at Newport, R. I. It is understood that this arrangement is for the joint account of the above named companies.

Respectfully yours,

H. Villard.

Although the Survey had essentially to do with the economic resources of the region, the maps would need to be of a considerable degree of accuracy. They were to serve not only to represent the results of the parties in the field, but also to aid the engineers of the railroad in choosing routes for preliminary surveys. Also, I wished to aid in determining areas where irrigation would be possible. Therefore the maps would have to show the vertical element in contour lines of equal elevation.

For this work I chose Mr. A. D. Wilson, who had shown great ability as topographer on Western Government Surveys.

The trained corps of my Census work furnished four geologists—Bailey Willis, Bayard T. Putnam, J. E. Wolff, and George Eldridge, to whom was added Waldemar Lindgren, and for chemist Mr. F. A. Gooch. Professor Charles S. Sargent took charge of the Forestry branch, and Professor E. W. Hilgard that of Soils, and Mr. W. M. Canby that of the natural plants for grazing. Samuel Williston became Secretary.

I don't believe it would be possible to get together an equal number of men more able, energetic, efficient, and anxious to make a survey succeed. All but two were young. Of those now living, at least four are now members of the National Academy of Sciences; the others are at the top in their professions, and Williston is Dean of Harvard Law School and only ill health recently prevented his appointment to be Chief Justice of the Massachusetts Supreme Court.

For offices I hired the large stone house on Greenough Place in Newport.

I divided my personal supervision between administrative work and reconnaissance expeditions to get the broad conception of the problems necessary for blocking out work.

Within a month the parties were in the field.

Mr. Oakes, vice-president of the N. P. R. R., said to me: "You will do an inestimable service to the road if you can discover steam coal. The lignite of the region is of little value, and good coal costs us at least $16 a ton."

I sent Eldridge, who had already reported favorably on a branch line to Butte, to prospect at a point near Bozeman, where bituminous coal was said to have been found. In the meantime I set Bayard Putnam and Gooch to experimenting on the possibility of making good briquettes out of lignites and tar products or the waste of bituminous coal mines. Within a few months we had a product that was successfully tried out on a Pennsylvania Railroad locomotive, and that could be made and delivered on the Northern Pacific road at $8. However, by this time Eldridge had dug into fair steam coal.

As bituminous coal of a rather inferior quality was being mined near Puget Sound, I sent Willis to prospect for a better kind on the company's land grant further south. Mr. Villard was at Tacoma, and gave him a letter to a Mr. Smith, who, he said, would meet him at the train. Willis, although

very young, looked still more boyish, and when he left the car and picked out the right man and said, "I am Willis," Mr. Smith looked around and said: "Where's your father?"

During the two years that Willis explored that coal field, young as he was, he became noted for his ability in managing a considerable number of very tough miners and laborers. There was a trial of a ship's captain for extreme brutality. The captain swore it was the only way to manage his crew.

The prosecuting attorney hurled at him:

"Do you mean to say that you and your mate can't manage a half-dozen sailors when the boy Willis up in the woods, easily and alone, controls ten times as many of the toughest scoundrels in the country?"

Late in the autumn Mr. Villard wished to have examined an occurrence of lignite at a remote point in North Dakota. To do this I sent Eldridge from Bozeman, where his examinations had convinced him of the future importance of that district.

On the way he fell ill of typhoid fever, but against the warning of the physician, and against my telegraphed orders and discouraging protests from a railroad surveying party that had been driven out by the snow and intense cold, he found the lignite, and digged deeply into it for fresh samples. This prevented building a useless line. Such was Eldridge. Another time, when on a stage caught in a Montana blizzard in a cold of 40° below zero, he saved the lives of the passengers. Taking the reins from the frozen driver, he brought the party through to safety.

Eldridge, by prospecting at different points with deep pits, found fair steam coal, and started a mine for the railroad. With his party of assistants, who did the mining work, he lived in tents till the cold reached 50° below zero. Then they built log huts in which they suffered more he said from invasions of skunks than from the cold.

My first reconnaissance trip started from Portland and Puget Sound. After discussing with Willis plans for his prospecting the coal field, and with Wilson as to point of beginning triangulation, I journeyed eastward through marvelous changes in the aspects of Nature. The lofty Cascade Range, running north and south, divides the west coastal region from the arid interior. From its green crest rise the high snow-clad cones of extinct volcanoes 10,000 to 14,000 feet high. Oceanward the moist climate nourishes a forest of gigantic Douglas fir and Alaska cedar trees eight feet and more thick. The trees were so closely set that I found it difficult to guide my horse among them. Roaring rivers rush seaward through deep canyons. It was in this wild region that I set Willis to explore for good steam coal, and there he found it.

I remember that on one of my later visits to his camps we crossed the dashing Carbon River on a remarkable bridge. Willis had felled a great cedar across about ninety feet of chasm, hewed the upper side flat, and made guards by driving in staves on the sides. Our party of nine rode over this at a fast trot. Then we all breakfasted in a circle on the stump.

My route lay across Washington and Idaho, and through the mining district of central Montana, traveling at first by steamboat on the Columbia, then on horseback, with one man as guide and packer.

The great agricultural possibilities that could be realized by irrigating the arid lands east of the Cascade Mountains with the water of the snow and glacier-fed rivers led to starting there a topographic survey.

Across eastern Washington my route lay over the vast Columbia lava fields. Here an area of over 20,000 square miles, inclosed by mountains, consists of horizontal beds of basalt to a depth of several thousand feet. The whole aspect

is weird. Everywhere the rivers and their tributaries lie deep down in black canyons.

Rich soil in the extreme northeast of Washington and the adjoining part of Idaho caused me to choose this region for another unit of the topographic surveying.

I remember little in the way of interesting incidents on this trip, probably because we rarely met any one on the way. I recall, however, one touch of the then passing frontier manners.

One morning, hearing language outside my tent that I thought meant immediate shooting, I looked out to find my man greeting an old friend. They were vigorously cursing each other's lights and livers, and casting horrible aspersions on the character of each other's mother, all the while shaking hands and overflowing with good humor. Both had been drivers of mule trains. Only the smile counted—and the artistic effect. It was a remnant of the vanishing time when earnest "exhorting the mule" led to efforts to excel in inventing new brands of profanity.

One of my reconnoitering trips in 1882 was to prepare for survey work east of the Rockies, north of the Missouri River. I had a freight car that had been adapted for use by the chief engineer. It had a kitchen and a good colored cook. As guest, there went an artist friend—Jervis McEntee—who, I hoped, would make some sketches for the report.

From the railroad northward we traveled on horses with a light pack train. I remember this trip as the only one in which I had been able to have decent bread—the one thing that in rapid journeys of exploration is both essential and practically impossible. I believe that cook could raise his bread under his saddle.

We left the car at Miles City, and took passage on a stage for Bozeman. I had taken a comfortable back seat. On the same seat were an elderly lady, the wife of a Bozeman

lawyer, and her son. I gave up my seat to a well-dressed and very good-looking young woman who stopped the stage as we left. Through the whole day her bearing, voice, and language were those of a woman of refined antecedents. We thought her the wife of some engineer going to rejoin her husband. The elderly woman had taken a liking to her. At noon the next day the stage stopped to deliver mail at Coulson, near the present Billings. Next door to the post office stood a saloon with the significant sign "*Chicago Jane's Boudoir.*" In the door stood a tall, much-bewhiskered man decorated with two revolvers, who, when he saw the young woman, rushed forward with:

"Hello Molly! Get out, Chicago Jane's waiting for you."

The poor girl turned scarlet, got down and went into the den.

The route we were to follow lay over the great plains where only construction camps spoiled the pristine character of landscape. In these camps were gathered together all the worst elements, male and female, of an active phase of frontier life. Dance halls, brothels, saloons for drinking and gambling daily relieved the worker of the burden of his wages. The only serious emblems were the spade, the pistol, and the rope. The earlier phases, struggles of immigrants with Indians, buffalo hunting, and the long trains of sixteen-mule teams were things of the past, and Vigilance Committees were growing rare.

Eldridge met us at a little construction camp of six new tents—five of them saloons, and one a boarding place. The next year this was the town of Livingston. From here out we made a geological section along the Yellowstone Canyon, and studied the geology of the region. Here was some of the grandest scenery of the Rocky Mountains. Looking across the great canyon, one saw, descending from great

heights, valleys whose walls swept down in the majestic curves of troughs left by vanished glaciers. This I thought would inspire my artist friend, but it was "too savage."

After inspecting Eldridge's pits near Bozeman, we took the stage to go north. Approaching Helena, we took up a passenger. He was a slender well-dressed man. I noticed that his hands were delicately shaped and well cared for, and took him for a gambler. When the stage entered Helena, two men stopped it and, saying something to our passenger, pointed to three numbers chalked on the wall of a house. That was all. The numbers were the mysterious sign that told the man that he must leave the town at once or be hung by the Vigilance Committee. He went.

Later, near a large camp, there hung from a tree evidence of the grim earnestness of these committees.

The lowest round on the social ladder was then thought to be held by the herders of sheep. Those who failed otherwise took to this despised work. Living wholly isolated, with only the flock and a dog, they often went insane.

However, one of my young men, after the end of the N. T. Survey, remained in Montana and, being stranded, became for some time a lonely shepherd rather than write home for money. Later he "beat" his way eastward, tramp-fashion, on the trucks under the cars; and he has ever since then held a responsible position in a business house.

At Helena I hired a guide and horses for saddle and baggage, and we were quickly beyond civilization. Our route lay along the edge of the great plains at the foot of the steep wall of the Rockies. We rode through miles of fine grass country intersected by deep gorges of the headwaters of the Sun, Teton, and Marias rivers. After a week we reached the Blackfeet Indian reservation.

It was the Fourth of July, and the Indians had come in to have a treat and receive supplies. For the treat there were

big tubs full of coffee, and vast quantities of biscuits. In our honor there was a war-dance. For hours, with the great white wall of the Rockies for a background, three thousand painted savages, on horse and on foot, enacted a weird scene. Toward the end, growing more and more excited, they rushed wildly away. The agent and his family seemed uneasy. I asked an explanation from one of my half-breed men.

"The Indians very mad; they run to the graveyard. They say 'the agent give us heap good things this time to make the white chiefs think he treat us well.' They say 'let the white chiefs go see the graves of the Indians he has starved to death!' Yes, they very mad."

The agency had a school; the teachers were the agent's daughters. The half-breed said the children didn't even learn English there, while in Catholic schools on other reservations they learned English and other things. All of which may have been true.

It was my intention to find an abandoned Indian trail up the Cutbank River, and cross the mountains to the Flathead plains. Wishing to explore some rough country, I sent all the party, except Logan, my head packer, by an easy trail to wait for me at the crossing of the Cutbank River. When I reached the crossing there was no trace of the party, and I supposed they would be found camped further up the valley. In vain we rode till within a mile of the gorge where the river leaves the mountains. Suddenly we saw a smoke signal rise from a hill near the gorge—a thin column broken into three successive puffs; then an answering signal from a distant hill. There was no doubt that Indians were there, and Logan said they were probably Crees from Canada. We were only about twenty-five miles from the border. The Crees were a hostile tribe, and we had only one pistol with us, for our arms were with the train.

We thought it best to go back to the agency, and from

there follow the tracks of our train. It was already twilight. Lighted only by the stars, we rode all night, crossing deep valleys and their streams with doubtful bottoms. Woe to the rider where these rivers have bottomed in a certain black shale, for the black mass is worse than quicksand. In the chill of an icy wind we rested a half-hour.

In the morning we looked down on the agency, wondering whether the "madness" of the Indians might not have led to a tragedy. We had been gone twenty-six hours, and had traveled in all about ninety miles, leading the horses for the last ten.

After having rested our mounts and eaten, I hired a wagon, and tying our horses to the back, and telling the driver to follow the tracks of the pack-train, we slept all day on the bottom boards. The party was found several miles too far downstream.

When we reached the mouth of the gorge the next afternoon, I sent Logan and a man ahead to find the trail. I was soon startled by three reports of a gun echoing among the cliffs. Remembering the Indian signals of the day before, I seized a carbine, and galloped up the gorge. Suddenly my horse snorted, as a struggling grizzly bear rolling down hill fell dead before me. Then came another shot, and soon a cinnamon bear followed. Logan had said that he was so afraid of grizzlies that nothing could make him tackle one. I did not care for the steak we cooked, but the artist caught some big trout.

The Cutbank descends through a wonderful gorge between limestone cliffs 2,000 feet high. Its upper and steep part was buried deep in hardened snow. Below the pass was an amphitheater—or *cirque**—its walls thickly covered with ice

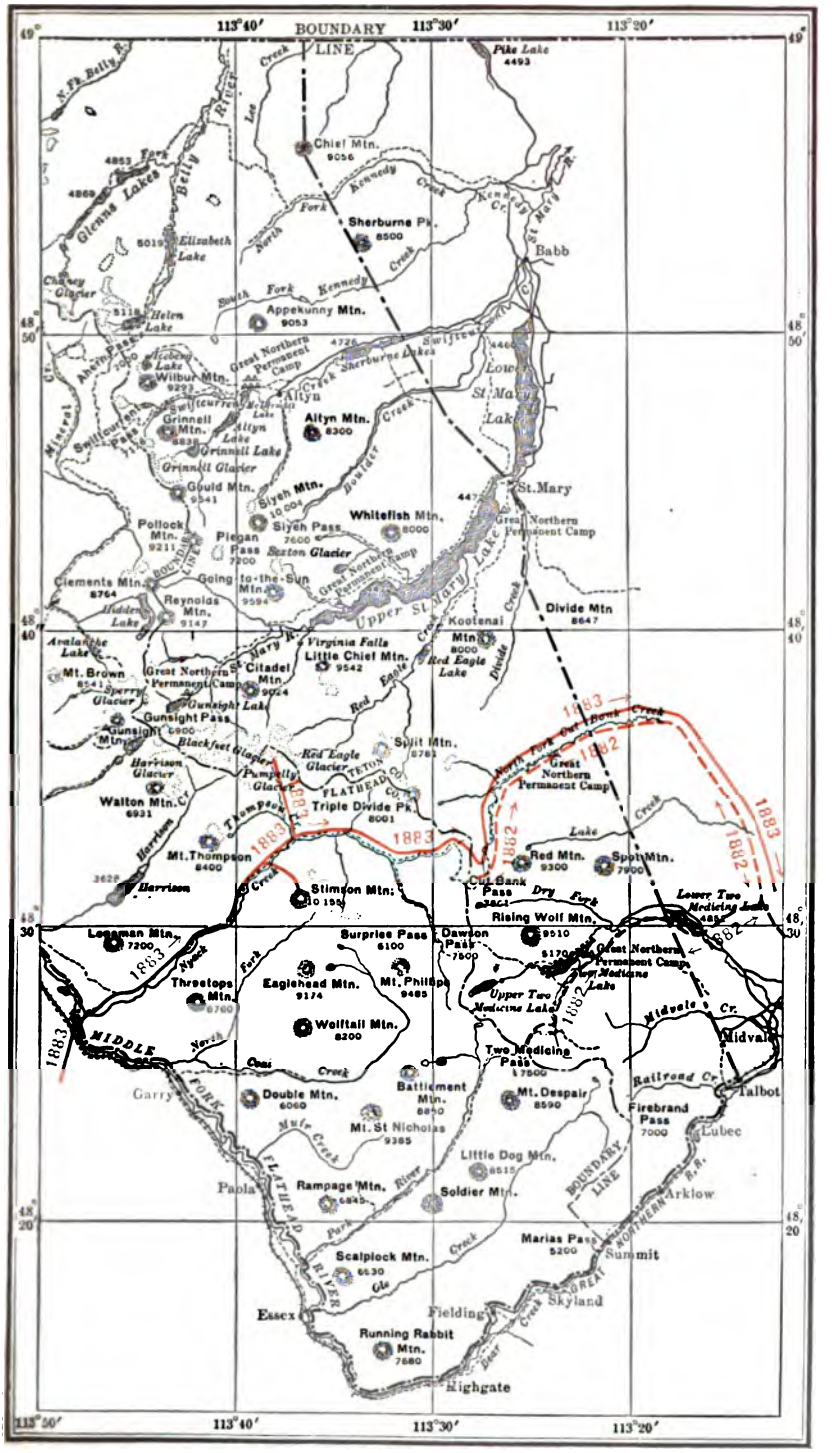
* *Cirques* and Amphitheaters are equivalent terms. They flank the crests of mountains above the line of perpetual snow. They are the gathering fields of snow at the heads of tributaries to glaciers which they feed. Through the action of frost in alternate freezing and thaw-

that extended nearly down to a deep blue lake, near which we camped amid heavy rain and high wind. At night the horses were so uncomfortable that they stood half-way in our tents. The next day, in brilliant sunshine, we cut our way upward in the ice to the top of the amphitheater wall. We were on the pass, on a narrow ridge between the *cirque* whose wall we had climbed and the walls of two amphitheaters on the other side of the Continental Divide. A great thickness of snow covered valleys and crests. We had come too early in the season and we were clearly not prepared to surmount the difficulties of the wild and unknown region that we looked over. I find in my notes that we next ascended the headwaters of the Two-Medicine River, to try the pass of that name, but found the way blocked by great landslides and ice. The way up the river lay along a beautiful lake between mountains that rose 3,000 to 5,000 feet above it, while beyond it, from between two *cirques*, a narrow cliff-bound peak towered 3,000 feet above the valley. I find that this is named Pumpelly Pillar on the recent Government map of Glacier National Park.

The scenery between the forty-seventh and forty-ninth parallel differs from that of the Rockies further south, where the mountain forms are monotonously due to the wear of older rocks. The mountains in this northern part are of limestone, and in this the ice of the glacial period has sculptured in its grandest manner.

Henry Holt had considered going as a guest on this trip. He also has assumed the martyrdom of a friendly reading of

ing at the contact between snow and rock, the heads of the valleys become amphitheaters ever widening, cutting back through the crest and lowering it. Where there are *cirques* on both sides of the range their intersection, in lowering the crest, leaves a sharp peak to partially represent the former height of the crest. It is chiefly to this process and these peaks that is due the name sierra (from *Serra*, saw), applied to jagged mountain ranges with crests that are, or have been, above the line of perpetual snow.



MAP OF AUTHOR'S ROUTE THROUGH WHAT IS NOW GLACIER NATIONAL PARK
From Map by U. S. Geological Survey

this manuscript. At this point I find scribbled on the margin:

"The real reason I didn't go with you was that I didn't want to leave the girl I was after and got."

We went eastward on the plains till we reached a small settlement on the Teton River. Here I bought a light wagon, and discharged all the train except four of the best horses. Thenceforth we drove four-in-hand—Logan, McEntee, the cook, and I. We drove via Fort Benton and through the Judith River basin, over the big snowy mountains to a little village in the Mussel-shell valley.

I was to meet Mr. Villard at Bozeman the next day but one. To do this I had to make a fast ride by a short cut, and send the party with Logan by a longer route. I hired a horse, and his owner—also named Logan—as guide. Before starting the man, who was already quite drunk enough, put an extra bottle in his holster. Fortunately I got from some one a general idea of the route. The guide's strong mare was evidently used to the habits of her owner, for she swayed from side to side to help him balance, and when I thought he would fall he always righted himself.

The man was a large and finely developed cowboy, and accustomed to ride only at a gallop or faster. When I set my traveling pace, which was a slow four-and-a-half or five-mile trot, he soon begged for mercy, but I insisted. After going a few miles and crossing a shaded stream, he turned back to drink water. He tarried sometime, and I found him stretched out in a drunken sleep. This seemed a chance to get his bottle. The mare stood facing her master, and as fast as I reached for the holster she moved away, but always keeping her head over him. So I roused the man and made him mount. Two loose horses had joined us, and I was afraid that we might be followed and taken for horse thieves. All through the day the guide begged for a change of gait,

but I knew we could not make the more than a hundred miles by changing the pace I had set. He sobered enough to know the way, and by dark we stopped for food for ourselves and the animals. After the man had put up the horses I disposed of the bottle.

We rested an hour, and rode through the night till we found a place where we could change horses and rest a half-hour. We rode into Bozeman in the evening, twenty-six hours after starting. We had ridden 108 miles. The next morning, finding that I had underpaid the guide, I went out to look for him. Then, too, I wanted to tell him how sorry I was to have used him up so roughly. My sorrow was premature. He was on horseback, ready to make the long ride back!

I said: "Logan, I didn't pay you enough."

"Oh, that's all right," he answered, pulling out a big roll of bills. *"I stood 'em off all night, and cleaned out the town!"*

At last this reconnaissance ended at the interesting town of Coulson. I had failed in the attempt to explore the region between the plains and the Flathead country, but I had been able to plan for the survey of a large region having great agricultural promise and practicable for irrigation; and I had, in the Judith River basin and Crazy Mountain country, roughly determined the outlines of a large basin of bituminous coal. Only prospecting could determine its value. It has since supplied fuel for the Great Northern Railway.

While waiting for the construction train to bring up my car, we camped on a high bluff overlooking the Yellowstone. The air vibrated in the intense heat rising from the vast extent of parched plains. Far beyond the meandering river rose the crests of the Rockies. In her fiery mood Nature had melted away all sharpness of feature. You lazily dreamed

of glowing plains and a hazy mountain wall. This was the artist's chance. To sooth the pangs of conscience he did penance all the morning under the blazing sun, and made a charming sketch.

At midday we saw a sight that showed how very sociable were the Coulsonites. We looked down on the whole male and female population of the town going to bathe in the river. They were laughing and dancing—*and wholly naked.*

They were not Indians or Dukhobours. They were, doubtless, all American citizens whose votes helped to make our congressmen and judges.

We looked out on a scene of the *vita mala* of the frontier, on a crowd of men and women thoroughly trained in their various ways of coaxing his last dollar from the railroad builder in return for what, at the moment, he thought a glorious *quid pro quo.*

CHAPTER XLVI

IN THE NORTHERN ROCKIES

THE most interesting of all my reconnoitering trips began early in May, 1883. The plan was to inspect the results of Willis's prospecting for coal on Puget Sound, and those of Eldridge on the coals in Montana; and after that to meet Professor Sargent and Mr. Canby at Billings. We would then together explore the northern Rockies, starting this time from the Flathead plains. My wife was to go with me, and return home alone from Billings.

We went by the Southern Pacific route, so that my wife might enjoy the scenery across the deserts of Arizona.

Excepting those of Arabia and Persia, I have been on all the deserts of the Northern hemisphere. Each has its peculiarities due to difference of climate, vegetation, and topographic features. Of them all, the desert of Arizona and Sonora is the most striking. It is a unique floral province, the home of the century plant aloe, the yucca, the giant cereus, and untold kinds of cacti. It is a plain forming the northern extension of the Mexican plateau, and sloping gently from a height of 5,000 feet in eastern Arizona to a sea-level at the Gulf of California. Across it from north to south extend parallel ranges of barren mountains with weird crest forms. They were known as the "Lost Rockies"—long islands rising from the great plain at intervals of thirty to fifty miles. The real wonders of this desert lie far south of the railroad, but the sculpturing of the distant mountains as seen through the clear atmosphere in the morning and

evening colorings, the mirages and, in season, the bloom of cacti and aloe, can never be forgotten.

Here I must tell of a double coincidence. As we neared Steen's Pass I went to the platform to see the place where, in my time, the last overland stage was destroyed by Apaches, and the superintendent of the line, the passengers, and the escort of Texan rangers killed. A tall man was explaining to another that it was here that happened the fight in which a troop of infantry was beaten in 1861 by Apaches. I ventured the remark that this happened farther west at Apache Pass. The narrator, somewhat vexed, answered:

"No, it was here. I have it from the account in Pumpelly's book. He was here at the time."

"He was mistaken if he said so," I answered.

Later the tall man, overhearing some one address me by name, asked: "Are you related to the Mr. Pumpelly who was in Arizona in the early days?" The other, hearing my answer, said: "Excuse me, my wife has for years begged me to find out where you buried her brother. His name was Tarbox." I told him the grave was at the *Canoa*.

A steamer took us from San Francisco to the very attractive town of Victoria on Vancouver Island. On the voyage down Puget Sound the weather was so clear that we had the luck to see in all their majesty the great volcanic cones that, clad in white, rise from the crest of the green Cascade Range.

After visiting Willis's explorations, we started across the mountains. Near Missoula there had just been finished a long trestle. I think it was 300 feet high. We had to cross it in a freight car. The first train to pass over it had an engine in front and one for safety at the rear. It was the Fourth of July, and the engineers and men were drunk. When the train had got onto the trestle, the crew of the rear engine took fright and cut loose. I understood why when I looked from the dizzy height into the depths below.

Logan met us at Missoula, and we continued our journey ten days by wagon. At Priest's Pass the daughter of the solitary family living there was a crack shot. At sixteen she had alone killed a grizzly. She also had a tame bear cub who violently resented my approaches. This girl had a pet owl that she called in from the woods for us to see. We could hear the bird's answering hoot, first from a distance, and then nearer, till at last it came into the house.

We were to pass the next night at the home of Mrs. General Logan—my Logan's mother. In the Deerlodge valley the thermometer stood at 119° in the shade, forcing us to take a short rest under a spreading tree. Shortly before starting again we saw a stage pass by, and when, in the evening, we reached our destination, we learned that only a half-hour earlier the stage had been held up near the house and the passengers robbed.

My wife left me at Billings, where I waited to meet the west-bound train bringing Sargent and Canby. With them came as guests Mr. Paul Dana and Mr. Stiles.

It was here, and perhaps at this time, that I saw a remarkable meteorological occurrence. The day was intensely hot, but a dark cloud rapidly hid the sky, a violent thunderstorm raged, and we could see the rain falling above us and beyond, and yet none reached to within a hundred feet of the ground. It was vaporized by the heated air rising from the hot bare soil. Many years later I saw the same thing happen on the desert near Anau in Turkestan. On a hot day in the California desert, between the coast range and the Sierra Nevada, I saw a storm gather over the western crests. Lightning rent the black clouds, and thunder rolled. Then the clouds vanished, and all was still. After perhaps a half-hour, suddenly the clouds gathered in the east over the crest of the Sierra Nevada, the storm raged, and again vanished. Through it all the sky above the desert had

stayed absolutely unclouded. The column of hot air rising from the sand had prevented condensation.

At our first camp Dana found that he had brought away some uninvited guests from the hotel at Helena. Armed with soap and a fresh suit, he sought a distant shady pool, and hung up the suit he had worn. After scrubbing and dressing, he looked for the infested garments. He had hung out a brand-new suit, made for the trip. He found rags. Somewhere there trudged a happy tramp.

Before reaching Flathead Lake we ascended McDonald peak—9,000 feet high. It commands some of the grandest scenery in America. Sargent thought it unsurpassed in Switzerland. Its most imposing canyon seems to have been locally named after me.

Beyond Flathead the way lay over a grassy plain, from which rose immense trees—I forget whether pines, larches, or Douglas firs. The Indian guide pointed out one around which his grandfather had dodged all night to elude a grizzly.

I think it was on this plain, and there, that the ground was covered with seemingly black insects. They were, perhaps, one-and-a-half-inches long and nearly a half-inch wide. I don't remember that they hopped, but as we advanced, riding side by side, they rolled back in a long wave.

We left the Flathead River to cross the great range of the Rocky Mountains. Our route lay up the valley of the middle fork, and what is now called Nyack creek on the Government map of Glacier National Park by Mathes. This map, by the way, is a model of topographic work. I think it took us two weeks of hard work to make our way to the continental divide. For much of the way the Nyack flowed between walls that rose 2,000 to 3,000 feet on either side. These were clothed with a superb forest of pines and larches. Reconnoitering in advance, we slowly picked our way 1,000 to

1,500 feet above the swollen creek. Once something happened that might have wrecked the expedition. The pack train was led by the usual bell-mare. The mule that came next was stopped by catching its pack against a tree, and did not dare to move. The next mule, bound to follow the mare, and trying to pass, hit its pack against the other one's, and went rolling and bouncing down the steep incline. One after another six more did the same. Five lodged on their backs 800 feet below, and one fell clear down, and was carried off by the river. The men descended to save at least the packs. Not one of the five mules was hurt! They had kept their legs folded under their bellies in rebounding, and they had always landed on their packs.

On one of them were the boxes of food tempting the packers to eat before the work to be done. Suddenly two more mules bounded over the men's heads, and landed, feet up, below. They, too, were unharmed. I would not have told this adventure were it not that Sargent and, I think, Dana are living witnesses.

I had noticed an opalescent hue in the stream, and that, as we came above a tributary, the color became milky. This meant the probable existence of a glacier at the source, though none was known in the United States Rockies. With one of the party I ascended a mountain which I suppose to be the one now called Stimson. Standing here, within the arc of a great curve of the divide, we looked out on a long series of sharply cut peaks rising from deeply snow-covered ranges. And to the north, descending from the very crest, there was a clearly defined glacier that seemed to end at the top of a high cliff. Through our field-glasses we could see that a block of ice, perhaps a quarter of a mile square, was missing at one side of the face.

Farther up the stream Logan and I ascended a valley coming from the direction where I had seen the glacier. In

a little over a mile we entered an amphitheater about two miles wide. Two thousand feet above, at the top of the *cirque*, the almost vertical wall of rock continued upward to form the terminal face of the glacier—itself a cliff of perhaps 500 feet of ice.

The missing block of ice was now accounted for. It had plunged down the 2,500 foot wall, and its acquired impetus had carried it several hundred feet up the opposite slope of the *cirque*, plowing a broad swath through a dense forest of large Douglas firs, whose trunks and branches, still holding their bark, lay in every position, like gigantic jack-straws. The fact that everywhere else the forest of trees of the same size was intact seemed to indicate a recent advance of the glacier, after a period of rest at least as long as the age of the trees.

Since my visit a large number of glaciers have been found farther north along the divide. What I saw was merely the lowest point of a glacier whose edge extends about two miles around the top of the *cirque*. From this ten superb waterfalls plunge down the precipitous wall of the *cirque* to unite 3,000 feet below.

A few years ago Professor L. B. Sperry came to ask the location of a glacier which people in Montana said I had found, and they had named after me. Later he sent me a photograph on which appears evidence that it breaks off regularly in great square blocks, as in my time.

Professor Sargent, who was making a reconnaissance with reference to forests, said that it was a remarkable fact that some of the plants and trees here, nearly 6,000 feet above the sea, belonged to vegetation of the much warmer Puget Sound botanical province. He accounted for this, if I remember rightly, by the possibility of frequent influence of the Chinook winds from the warm current on the west coast.

The presence of glaciers from here northward is probably due to moisture brought by the same wind. They are remnants of greater ones of the ice period, when they filled the amphitheaters and flowed down the valleys. They end now at the top of the *cirque* walls 6,500 to 7,000 feet above the sea, excepting the Agassiz glacier whose lowest point is at about 5,800 feet.

Our way to the pass lay about 1,000 feet below the crest around the upper part of an amphitheater. I had looked down upon it the year before. It was now wholly bare of snow. The surface was covered with loose limestone shale that, on the steep declivity, made very difficult the footing of the animals. We had one accident, losing a horse carrying Sargent's voluminous collections and all of our guns. A slip of his hind feet carried him over, striking the ground only three times as he fell about 1,500 feet.

On July 10, 1882, I had found this *cirque* filled to the top with snow, the eastern approach to the pass ice-bound and the valley of the Cutbank deeply buried under snow. Now (August 4, 1883) *cirque,* pass, and valley were wholly free from snow and ice. It is well to remember these dates if you ever think of visiting Glacier National Park, for among these limestone mountains—from lofty crests and in *cirques*—you will see the grandest scenery in the United States; and the best time to see it is when, from high lying snow-fields, waterfalls are plunging 2,000 feet down almost vertical steeps.

A sharply cut pyramid towers 1,000 feet above the pass, its four faces forming the upward extension of the intersection of four amphitheater walls—two on each side of the crest. And it indicates a lowering of the crest here during the glacial period by at least 1,000 feet.

As we descended the Cutbank valley, on the eastern side of the divide, we passed a succession of falls 1,500 and 2,000 feet high. At one point we watched, for half an hour, a great

mountain goat standing immovable a thousand feet above us, his long, white hair seeming almost to touch the ground. He waited until our Indian, climbing all this time, had reached the vantage point—then with one long spring he vanished.

In 1883 came the collapse of Mr. Villard's railroad combination. I don't know the real underlying cause. I had, and still have, great admiration for Mr. Villard, and for his prophetic insight into the future of the vast Northwest. I have assumed that, in his vision of the future, he failed to see the human and financial obstacles near at hand.

The Northern Transcontinental Survey, throughout the three years of its life, was opposed by nearly all the officials of the roads, especially by those of the land departments, with whose schemes it interfered. One of the chief officials of that branch, after exposure of frauds running into millions of dollars, committed suicide. Mr. Villard was our staunch friend. During his recovery from nervous prostration, as soon as he could see any one, he sent for me to tell me that the survey was the thing he felt most proud of.

The breaking up of the survey was a great blow, not only to me, but to the corps of men who had earnestly worked to make it a success. The results of the past year were still in the notebooks, ready to be worked up in the winter. Of the survey nearly 30,000 square miles remained to be platted, and a great number of analyses to be made of the samples from Willis's extensive explorations of the coal field of Puget Sound, and from Eldridge's prospecting in the coals of central Montana. These and the past year's work of the other branches made up the greater part of all of the survey's results.

I was ordered to stop the survey at once, and disband the force. My appeal to be allowed to have the results worked up was referred to a committee. When I met the chairman, he refused bluntly. When, to impress him with the impor-

tance of the maps, I showed him one of the previous year's survey, he asked what was the meaning of the contour lines. I couldn't make him understand that they were lines of equal elevation. Nor could he understand the value, to the roads, of the extensive prospecting for steam coal. He thought it useless to analyze the samples or to report their sources.

To end discussion he said:

"Mr. Pumpelly, when we want maps our engineers will make them, and when we want coal we will send our men to look for it."

So information that had cost very many thousand dollars was to be thrown away, instead of being made available at a cost of one or two thousand dollars.

The survey was stopped, but the maps were drawn, and the analyses were made, largely by the volunteer work of the members of the corps, and were in part incorporated in my volume (No. XV) of the Tenth Census.

CHAPTER XLVII

ON THE SIERRA MADRE OF MEXICO

In 1884 I reëntered the U. S. Geological Survey, in charge of the New England division, taking as assistants Bayard Putnam, J. E. Wolff, T. N. Dale, W. H. Hobbs, C. L. Whittle.

For five years we struggled with the obscure structural problems of the Green Mountains. Did we solve them? Who knows? An old half-breed guide in the Northwest always decided weather predictions with "probably yes, probably no."

I think it was during this period that C. R. Van Hise and I were consigned to a field study of some questions in pre-Cambrian geology. Whether we settled them or not, the attempt to do it was one of the most delightful experiences of my life.

Between 1880 and 1890 I made several professional journeys to examine mines in the Sierra Madre in Mexico. On the first, I went from Mazatlan to Culiacan, and there engaged a guide and horses for the long trip to the Sierra. Just before leaving the inn there came to me a little girl perhaps seven years old. She was an orphan and longing for her mountain home. She begged me to bring her a certain big nut to keep in memory of happier years, when this kind of nut had been her only plaything. When I brought her one she danced with joy.

Once, in the twilight of a hot day, I rode into the midst of a *fiesta*. The air was full of music. In the simple plaza dark-eyed, gaily-dressed girls were dancing with picturesque men, who in their native costume looked like bandits. At

an adobe hut facing this scene I found the hospitality of a modest meal of *tortilla,* chocolate, and *chile con carne.* A rawhide stretched on a low, rough frame served for cot out of doors, on which I spread my blanket.

I talked a while with the old man of the house and his wife, and admired their grandchildren—one a beautiful girl of five or six years, who was caring in a motherly way for a younger sister. Both the old and the young had the attractive manners of the Latin races. I went to sleep lulled by the rhythmic music of the dance. I awoke in a bright moonlight. The plaza was deserted, but near me a woman's voice was sweetly singing. After dozing off I awoke again, and this time heard a man's voice in a low tone of earnest persuasion. When I became again conscious there was no moon, the sweet singer and the entreater no longer there. A child was calling "Mama! Mama! Where is Mama?" The older sister was crying "Mama is gone!"

In the morning I learned that it was the children's mother who had sung near my cot, and that she had gone off with the man. The husband was the son of the house, and was working at a distance. The result would be a double tragedy.

In these villages the people were very poor. Their every-day dress consisted of one thickness of sheeting. As soon as the sun was down every one seemed to be seized with a fit of coughing.

Once leaving the arid *tierra caliente* near the coast, I entered the valleys of the foothills of the Sierra Madre, a zone of luxuriant vegetation. Among this I remember seeing two remarkable plants. One was a large wide-spreading tree, from which there was a continually dropping liquid. The other was a vine that wound (like giant serpents) along the face of cliffs and around trees. Where two of its branches touched each other they grew together, and in this way would unite on the trees to form a solid covering and hide the

trunk of the host. In one instance this vine had solidly inclosed a palm for over twenty feet to near its top, and from there had sent branches outward and upward to form a superb tree. Only the top of the palm, projecting from where the big branches forked, remained to show the history.

Among these foothills I came among a people who claim to be of pure Aztec origin. The men were tall and well developed, the women rather attractive—some were beautiful. I was hospitably received with the customary embrace.

Everywhere the women were making drawn-work, not for sale, but for their own petticoats or towels, or for altar cloths and priests' garments. The work was generally fine, and, as it differed from valley to valley, when a woman came from a distance most of the night would be spent by visitor and hostess in studying each other's designs.

As I wanted to get closer to these people I became interested in this work as a subject to break the ice, and I bought their petticoats, old and new. I remember, after buying one of these, the young lady saying to her mother: "And now what will I have for the *fiesta* of San Juan?"

One morning, in leaving the house of a young couple who refused to receive payment, I asked what I could do for them at Culiacan. After a consultation the young wife begged me to send her a little piece of scarlet cloth, "for it was good in sickness." I think she said it was boiled, and the liquid drunk.

After I had examined one mine I started for another, several days ride distant. It was necessary that I should catch the first steamer from Mazatlan, and to examine the mine I would have only two nights and the intervening day. I reached the mine about ten o'clock at night. My client in San Francisco had thought it safe to save $20,000 by taking the risk of having the mine examined before paying for an option. But I found Ashburner already on hand for

another purchaser who had bought an option. There was, however, a chance that Ashburner's party wouldn't buy. So I went at once underground, after arranging to have all the miners out of the mine while I should be in it, and to have meals sent down for me and my own miners.

My men's task was to blast samples across the vein, and to break them up into pieces of about egg size. Then we mixed these thoroughly on a rawhide, and dividing the mass by two lines crossing at right angles we rejected two opposite quarters. The men went ahead to blast at regular intervals, while I finished the sample by successive breakings and quarterings till it was reduced to four or five pounds and sealed in a bag. It was one of the hardest jobs of my life. Like a convict stone-breaker, sitting on the ground with a rock between my legs for anvil, I broke and quartered samples for twenty-seven hours. I got to the surface at one A.M. and at three left the place in the stage carrying Ashburner and me. I had done my work, and had not seen the country by daylight.

My samples showed $1,800,000 "in sight." I reported that it would cost about $600,000 to extract the silver. The company actually divided just $1,200,000.

I remember a lucky escape in descending into a mine on one of my Mexican trips. I was standing on the rim of an iron bucket, holding on by the rope, and being lowered slowly by a windlass worked by two Mexicans on the surface. Suddenly the seat of my trousers caught on a spike in the casing of the shaft. My feet were lifted from the bucket. For an instant I was on the threshold of eternity, then my weight tore me from the spike and I fell in a heap to the bottom of the bucket instead of a hundred feet down the pit.

On another trip, going from the East I crossed the plateau of Mexico to its western foothills. This time Bayard Putnam

was with me; the Alcalde of Parral selected my retinue of four or five.

Of this journey only a few impressions remain. The route lay over the great table-land 7,000 feet above sea-level, and nearly all the way through an open forest of stately pines. Now and then we descended several thousand feet to cross a river.

It was February, there was no rain, and we took no tents. I remember awaking in the dawn of a frosty morning and seeing the men standing in a picturesque group for warmth around a blazing fire. What made me remember the scene was the appearance of old Ramon, the chief of the party. He was bald at the top, and tried to hide it with a long, carefully cultivated lock of hair. This tuft now dangled most effectively at some distance from one side of the head. I laughed, little thinking how much trouble I, too, was to have with a similar lock.

There was to be one critical point on our route, where, in order to cross a deep valley, we should have to go through a group of houses that were the homes of a gang of robbers who terrorized the country for a hundred miles along the plateau. It was also the only place where we could get water and fodder for the animals. Fortunately, there were only three or four men visible; the rest were, doubtless, away on a maraudering raid. After the women in one of the houses had given us supper, I asked for their drawn-work, and several pieces were spread out. In bargaining for one I had laid a silver dollar on the table, and this was missing when I came to pay. Besides the men of the place, several children had crowded around us, and one of whom had, doubtless, stolen the money. My insisting that it had been on the table produced a wild scene, and one ruffian with drawn knife was pushing toward me shouting that I called them thieves. My men drew pistols, and it looked serious. But Putnam's

presence of mind saved the situation by quickly saying to me with a wink: "I saw you put the dollar in your pocket." This calmed the storm. I heard later that the gang was at that time being rounded up in the mountains, and that all were shot.

When we reached the point where the western edge of the table-land drops almost precipitously down to the hot country, the men packed away their coffee, and thenceforth in its stead used a light gruel of something like sago.

As we descended, the vegetation changed rapidly, most markedly perhaps in the successive varieties of pine. On the way down we passed a night at a ranch called Santa Maria. Here the daughter of the house was making remarkably beautiful lace. I asked her to make a skirt for my wife. The next morning she told me the materials would cost twelve dollars. It would take her a year to make the skirt, and did I think eight dollars would be too much for her to ask for the work in making it. I gave her the twelve dollars, and told her to send it to a firm in Parral, where I would leave instructions to pay her whatever price she asked, for she should surely ask more than eight dollars. A beautiful skirt reached my wife in a roundabout way.

At last we came to the region of oranges and of the higher altitude cacti. When we rose again among the foothills we came to a village where we found hospitality with an interesting family—a mother and several really beautiful daughters. Although they had light complexions and blue eyes, they claimed pure Aztec descent and no Spanish blood. The two older sisters, probably sixteen and eighteen, had a quiet charm in bearing and in talking about their people, and getting us to talk about the outside world. These girls, brought up in a half-ruined adobe house, would have felt equally at ease in any society. There still lingers in memory the inspiring strains of their guitars and the sweet native songs.

Another trip to Mexico was made to report to the owners on a mine on the Sierra Madre which their engineer said was "equal to twenty-five Comstock lodes." When I learned that the mine was in an old Apache stronghold, I hesitated; after once escaping with my scalp I didn't want to tempt fate. But an answer from the War Department insisted that the Indians were all under guard at the San Carlos reservation in Arizona. Gooch went along as assistant.

In the night, between Benson and Magdalena, we were sitting together in the middle of the car. When the conductor called out "Crittenden" I turned to my companion, saying: "Gooch, we're only twenty miles from my old stamping ground. I never thought to come so near and get away again." In the same instant there rang out the sound of a rifle, and a ball, entering a window just ahead on the other side of the car, passed in front of Gooch's nose and just back of my head, and through the window behind us, scattering glass on us on its way. The only other passengers were some officers and their wives at the end of the car. One of the ladies, by the light of the flash, saw a man fire the shot.

We made the journey of nine days on horseback, from Magdalena eastward into the mountains under the guidance of Charles E. Woods—a fine specimen of the cowboy type. He was the captain of the Conducta, *i.e.*, his business was to take to the mines the donkey trains loaded with silver for payrolls.

With only one Mexican packer, he had safely brought through sums aggregating into the hundreds of thousands of dollars. He had the best cowboy qualities, strong reserve force, never drank nor smoked, and he swore only when necessary. I came to like him, and thought he would be just the man to organize and run a cattle ranch.

An examination, instead of confirming the company's engineer's statement, proved the mine to be a desperate failure.

The vein, only a few inches thick, had been opened for a considerable distance underground—far enough to determine its probable character and richness. It might make a small mine, needing a small stampmill. Over a million dollars had already been spent, and the machinery for a mill of eighty stamps, to be brought hundreds of miles on mules, was scattered all the way from the Pacific coast.

Were the Apaches on the reservation? We were corralled at the mine by Geronimo, and our whole force of perhaps fifteen whites was under arms for two weeks, while the surrounding country was being raided.

After consulting the superintendent I decided to propose to Woods to start a cattle ranch, to be organized and managed by him, and he to have a joint interest. On the return journey I found that he had been brought up to the business, and that he knew just the ranch near the border. When I reached home I proposed the plan to a friend, and that he should go and form an independent opinion of Woods. He went and came back ready to invest. We sent Woods $15,000 to buy cattle. After two or three months Woods wrote that he was on the way to the ranch with a herd. He also sent me a scalp that he had taken in a fight.

Several months later a friend wrote saying that we might be interested to learn that Woods, having driven some cattle to the Indian reservation, had in one night at cards lost the herd and all his money, and had gone into hiding. There remained only the scalp. I looked for it in order to divide the assets with my partner. Alas! Some one had stolen even that. About fifteen years later I received a telegram from the marshall at Cheyenne: "We understand you have offered a large reward for capture of Charles E. Wood, alias (no end of aliases). We hold him for instructions. Answer." Let us hope the marshall isn't waiting.

I made my report in New York at the house of the president

of the mining company. As soon as I had finished there went a telegram that closed the mine. The night was intensely cold, and, as we were in the hall getting ready to leave, the secretary remarked that he expected to freeze before reaching his hotel. The president laughed, saying: "Never mind, Robbins. They'll warm you up to-morrow at the stockholders' meeting!"

CHAPTER XLVIII

DUBLIN, N. H.

We found the Newport climate too relaxing during summer for the children, and sought a place in the mountains. When in 1883 we visited at Dublin, N. H., my wife's sister, Mrs. Hill, we walked through long abandoned roads to a hilltop, and looked out over a tree-bordered lake to the far-away Green Mountains. We had found what we craved. Could we get it? We should need to buy two adjoining farms.

I authorized Mr. Gleason to pay for them up to a stated amount. He bought them for considerably less. When, a month later, I went to stake out the position for a house, I found the hill enveloped in a dense cloud—no mountain, no lake. Fortunately I was able to find where I had stood with my back against a stone wall, and noted the different features of the landscape. Walking forward from this point, I chose the spot for staking. An architect made a plan embodying my wife's ideas, and Mr. Gleason let the contract. We did not see Dublin again till we came there in the next June, and found the house furnished and dinner on the table. Thanks to Mr. Gleason, and to my making none of those changes which are the builders' opportunity and delight, there was not a cent for extras in the builder's bill.

My wife called our place "On-the-Heights, *Auf der Höhe,*" for it covered two big hills with a broad valley between and stood 1,800 feet above sea-level and nearly 300 above the near surroundings. The wild and rugged mass of Monadnock towered on the left. Several hundred feet below us lay Monadnock Lake, often aflame with all the colors of sunset,

"ON-THE-HEIGHTS," DUBLIN, N. H. THE HOUSE

From a photograph by Elise Pumpelly Cabot

while far away to the west, beyond sixty miles of lowland, the view was limited by eighty miles in length of the Green Mountains.

But the real reason for the name lay in a few words spoken many years before. We had met as guests of mutual friends. The second day of our acquaintance we were driving with our hosts in the Catskills. Our first walk in the evening had led us to a high cliff. Far beneath us a mist faintly veiled the great river, and over all the light of the moon added a sense of enchantment.

We were strangers to each other and had strolled out for a few minutes in the evening air. To break the silence I spoke of the exaltation I had felt when alone on great heights. Almost as if speaking to herself my companion said: "I understand, for under the mystery of the stars my mind, or soul, seemed to merge with some spiritually higher medium beyond the pettiness of life. Was it in the nearness of God?

"It was alone in the high Alps that Eckehardt was inspired to write the *Niebelungen Lied,* and it was alone *Auf der Höhe* that the banished Irma did penance for her sin."

Something in the low, sweet voice, as well as what she said, made me turn. There hovered still on her face that which betrayed beneath its classic beauty a poetic and spiritual nature. I had struck a harmonic chord that was to vibrate forever.

One could mark a dial on the western veranda to tell, not the hours but the day by the salient points on the Green Mountain skyline behind which the sun disappeared in its apparent northward and southward course.

Dublin was then near the end of its transition from the old to the modern New England social complexion. During forty years the younger generations had carried their vigor to build up the West. The older people had died, and the country consisted of abandoned farms growing up to forests

abounding in cellars of vanished houses, dying orchards, and massive stone walls.

The township still contained some fine specimens of the old stock—men whose sons had made their mark in New England and Western cities. Of these I remember an old gentleman who had a fine farm and always cast the only Democratic vote in the township. Another old man, both farmer and either carpenter or shoemaker, kept up his reading in Latin authors.

From its beginning about 1880 the summer colony has been mostly made up of interesting men and attractive women, among them men of the highest rank in art, literature, politics, and diplomacy. Here Abbott Thayer and George deForest Brush did their best painting, and here Thayer evolved his theory of "concealing coloration."

In the early days Joseph Linden Smith made the *Teatro Bambino*. All of us, young and old, shovels in hand, helped in digging the pit. The whole Smith family, mother, sons, and later the daughter-in-law and grandchildren, were born actors. They and Brush formed a nucleus around which the years have grouped others including "Mark Twain," who was always ready to bring into service his wealth of humor in talks or in acting.

During all of the first twelve years the life at Dublin was simple. Dinner was eaten at half after one and supper at seven. This and the absence of evening dress made possible the delightful impromptu evening gatherings that were the charm of early Dublin.

Nearly all the families had children ranging from infancy to fifteen—and it was not unusual to meet a band of eight or ten mounted children in Indian costume tearing along the winding roads. When not on their ponies they spent the days in exploring the mysteries of Monadnock. They are all grown up now and have their own little ones, but the free

life of those years has left its stamp on their bodies and minds.

Memory records, but I dare not, many gossipy incidents in the thirty years' life of this gathering of exceptional characters. They include, however, no scandals, but are too personal to put on paper.

Speaking of Thayer's protective coloration, I remember an interesting evening. It was at a time when, after the Titanic disaster, there was discussion as to the ability of lookouts to see an iceberg at night. Thayer took several of us, including an eminent physicist, into a field. The full moon stood about thirty degrees up in the east; to the west of where we stood the field was flat with a space of open sky. Thayer had erected nearly vertically a sheet of white cloth perhaps ten by twenty feet in size and about one hundred feet westward from us, and asked us to find it. It was absolutely invisible against the sky until he had it moved to where it hid the lower half of a tree.

There come to my mind two talks with Franklin MacVeagh relating to two greatly different men—Bryan and J. D. Rockefeller. He was just back from the Democratic Convention of 1896 at Chicago. In describing the overpowering effect of Bryan's speech, he said that, although of course wholly opposed to Bryan's ideas, he could not help being, like all the throng, thrilled by its eloquence.

The other was after coming back from a meeting of the trustees of Chicago University, and it impressed me deeply. He had sat for hours under the trees talking with Rockefeller. MacVeagh said that "Rockefeller's mind was wholly absorbed in working out the problem of how his own and other great accumulations of wealth could be left without doing harm." The outcome of that thinking of a great mind has been the Rockefeller Foundation—an untold benefit not only to America but to the world.

Abdul Baha was one of the distinguished visitors to Dublin. One day he gave a talk at our house and, after lunch, feeling tired, he was shown to my wife's room to rest.

Not long after this when on our way to Burlington we stopped at a summer resort for lunch. A lady, seeing our name on the register, introduced herself, saying: "Oh, you are from Dublin! Did you see Abdul Baha?"

"Yes, he lunched with us the other day and he rested on my bed."

"He lay on your bed. Oh, how wonderful!" and she came and reverently kissed the skirt of my wife's dress.

Once in Askabad in Turkestan, while talking with a Persian merchant, he introduced me as an American to a tall and dignified man who, he said, was a Babist. The visitor smiling said: "I'm told that there is a Babist church in Chicago." When he left, the merchant said: "He is my dear friend." I asked: "How can you, a good Mohammedan, love a heretic?" "I am a good Mohammedan but the Babists are the best people in Persia."

The mantle of the martyred Bab fell on Abdul Baha's father and descended to Abdul Baha. The religion is very pure and seems to be spreading in Persia and Syria. It accepts as inspired all the great religions and prophets, and it may be the leaven that is to modernize Islam.

After a serious epidemic of tonsilitis in Massachusetts had been traced to the milk of a well-managed dairy, we established a bacteriological and clinical laboratory, supported by subscriptions, and under the direction of Dr. E. C. Stowell assisted by expert bacteriologists. As a result, during the ten years, more or less, of the infancy of the children of the colony there was an absence of diseases traceable to milk. The laboratory also successfully attacked the mosquito problem by draining any one's land when asked.

It had, however, to weather some storms from within and without.

Some time during the height of prohibition sentiment in Kansas I had some opportunities for observing the working of Kansas prohibition. In talking about it with my lawyer in Topeka, he said:

"Yesterday while walking with my brother he was seized with gripes, and entering a drugstore asked for a drink of brandy. As he had no doctor's prescription the clerk refused, saying that they never, under any circumstances, gave out any liquor without a physician's order.

"As he was talking to me I saw a notorious and ragged drunkard coming down the street. 'See that man,' I said. 'Give him a dollar and send him in for the brandy and give him a quarter for a drink for himself.' The man soon appeared wiping his lips, and handed over the desired bottle. The clerk knew the man wasn't a 'spotter.'"

The same day I started for the East. The day was very hot and drinking water had long before given out. A long delay kept the train at a station and opposite a saloon which could supply only "pop" and other unsatisfying soft drinks. On the other side was a square, and a sight that interested me: for two men were coming from a building and each carried a bottle. They belonged at the other end of our car, so I made bold to ask for a look at the label. It read:

P.D.G.B.

EXHAUSTION CURE.

GOOD FOR CONSUMPTION

Dose according to requirement.

I sought the source of those bottles. At one end of a billiard room a man was selling them. As I edged my way

through the crowd a man ahead of me asked for a bottle of beer and was refused because "Kansas prohibition was iron-clad in Kansas." As the applicant turned away I handed over a half dollar, asking for a bottle of Exhaustion Cure. As I entered the car a lady sitting opposite me looked up with an appealing smile. "I have a corkscrew," she gently suggested. We found it was first-rate Milwaukee beer. Then I went to the two men and asked the meaning of P.D.G.B.

"Oh, we've solved that!" came the answer. "It means 'Pretty damned good beer!'"

"MATZ' FUNE," ROSELAND, GEORGIA, 1886

CHAPTER XLIX

ROSELAND

In our first summer (1884) at Dublin my associate, Major T. B. Brooks, visited us and introduced a new phase in our life. He persuaded me to buy a plantation adjoining one he had bought in southwestern Georgia. So the following winter found our whole household and my geological assistants established in the village of Bainbridge, pending the building of quarters on the plantation, which was five miles away.

My purchase consisted of 1,500 acres of fine farming land through which ran a table-land covered with a primeval forest of great long-leaf pines, and fringed with charming glens clothed with magnolias, bay-trees, buttonwood, azalias, and yellow jasmine vines. These glens descended to sparkling brooks that, shadowed by tall trees and undergrowth, meandered through the cultivated lowlands.

It was among the great pines on the plateau that we built out settlement of three log houses—one for sleeping, one for living house, and one for the service and kitchen, all connected by a covered veranda. They were the common log houses of the region. Split shingles were on the roofs. These also stopped the wide spaces between the logs, though not so fully that one lying in bed couldn't see the stars.

Such was to be our winter's habitat. It never grew cold, except when once or twice in the winter we were lashed by the tail-end of a great storm in the North that knocked the mercury in a few hours from 70° to freezing or to near it; and then we roasted in the heat of the fat pine and oak fires during the three days of steady climbing of the mercury.

We called the plantation "Roseland" because in happier times it had contained a garden with three hundred varieties of roses. The Brookses called their houses "The Pines." We named ours *Matzu Fune*—Japanese for "wind sighing through the pines."

I had bought my place because of its beauty as a region for rest and to roam in. But Major Brooks had a great store of restless energy. In successful farming in the North he had shown the same marked ability as when chief of Gilmore's staff, and later in managing mines and furnaces on Lake Superior, and in the Geological Survey of Michigan; so I listened to his alluring advice and we joined our plantations and bought neighboring ones till we had nearly 6,000 acres. We would stock them with cattle and do scientific farming. The Georgia planters were staggering under mortgages bearing 12% to 18% interest, and were therefore forced to plant cotton at a loss because it was a "money crop." We would show the way to success.

For certain reasons my wife and I had thought it best to bring up our children in the country. So we had avoided the relaxing Newport summers and had chosen for that season the bracing mountain air of New Hampshire. And for a similar reason we welcomed the South for an all winter out-of-doors life.

For eight winters the eight children of the two families, ranging from seven to twelve years in age, lived largely on horseback, exploring vast open pine forests shaded only by gnarled crowns a hundred feet above. Governesses and tutors had a hard time of it and, I fear, often despaired. However, Nature helped out.

As a place of delight Roseland was a great success, but as a scheme for improving bank accounts and for elevating the South it did not make us happy. Our various experiments as to its possibilities turned out well. On trial tracts

we raised in quantity and quality the best crops of Sumatra tobacco and of some other things, but we lacked the capital for development of the large estate and we learned the lesson that the master mind must be on hand all the year round.

This showed in small things as in large ones. As an extreme instance, to avoid having to buy each fall large flocks of turkeys and chickens, we hired a man to raise these on a large scale. It had been "the dream of his life." So we left to him the power to draw a given sum for building and buying. When we came the next autumn there were neither the man, the money, nor the chicken houses and chickens; there was only the experience.

Georgia possessed only very inferior cattle, the descendents of those imported by the first settlers. They seemed to be reversions to the small stock that Cæsar found in England, a result of having for centuries been left to run wild on the scanty grass of the pine forests. We introduced Devons, and soon had a fine herd of several hundred head. The Georgians did not appreciate the difference, and seemed to prefer the poor native beef. So we sold at a loss.

It occurred to Major Brooks that among other things, as we were near winter resorts, it might pay to manufacture a high class of sausages. So he wrote to makers of the needed machines. The result was both startling and illuminating. The firms assumed that we were butchers, and with their price-lists sent a sheet marked "*Strictly Confidential.*" This contained three recipes for treating meat to be made into sausages. The first recipe was for meat that was "only tainted."

The second for when it was "well gone."

The third for use when meat was "putrid."

This ended not only any further thought of making sausages, but also of ever eating them.

Among the people of this part of Georgia one saw everywhere the great change wrought by the war. Families once rich and socially important were now poor and their second generation working for a living. Prosperity seemed to attach to the formerly poorer element. We never saw any sign of our being disliked as Northerners. On the contrary, we were sometimes serenaded. It was natural that we should see amusing sides of remote Southern village life which it would hardly do to relate, but one instance I will risk. We were calling on the third bride of a lawyer. My wife asked whether she was born in the village.

"Oh, no," she answered. "I was born in Massachusetts." Whereupon her husband announced:

"Yes, I always go North for my wives!"

One winter we had a succession of diseases. Among others our Elise was very ill of some very obscure ailment. There was a really good local country doctor. He was baffled. I had the great encyclopedic dictionary of Larousse, and this contained all knowledge, including everything then known, relating to all the diseases in the world. This was the doctor's opportunity. For weeks he lived with us, and between the covers of those seventeen big volumes. Every few days he would diagnosticate some new disease for Elise, so that by the time she had exhausted the pharmacopoeia and been cured by Nature she had run the gamut; and incidentally the doctor had gone through a French course of medicine. And the amounts of his, not exorbitant, bills during several years set him up in successful practice in a large Southern city.

The children often rode "bareback"; but when they formed a cavalcade of six to go into Bainbridge their mother told them that the Southerners objected to a woman's riding astride, and that before entering the town they must ride with both feet on one side. They soon got used to this,

and before long could jump onto the trotting ponies and ride standing almost like circus girls.

The negroes were a constant source of interest and amusement. The older ones had been slaves of good masters, and had preserved the tradition of honesty and good work. The younger generation, especially the men, were generally not desirable. Honesty, however, was not expected to extend to within the door of a chicken house, and the protesting squawk of hens was often heard on dark nights.

Our stableman, Boss Crawford, was a good-looking mulatto who had a very handsome wife. When my wife once remarked to Crawford on the beauty of Julia, he interrupted: "Miss Eliza, I'se obleeged to be handsomer than my wife."

We had built a church for our hands, and Boss Crawford, who prided himself on being a hardshell Baptist, was the preacher. One Sunday he had begun on the Creation, when noting the presence of my family and my geologist assistants he hesitated, but, bracing up, remarked:

"What though there be geologisses," and went on.

There was a fine old negro whose evidence I was told would be accepted in court in preference to that of many of the whites. One day I asked him: "Henry, where were you born?" His lucid answer was: "I was born mosely about here I reckon, Marse Pumpelly."

One day a very old darkey, who was born in Africa, asked for work. I didn't need him, but when he said he was going to be married, and had got to get a dollar and a half to pay for the license, I set him digging for an asparagus bed. He went off happy with the money, but came back the next day. He had spent the money for the license only to find that the woman had married some one else.

There was no burdensome monotony in our life. The six girls and two boys of the two families were all within the range of ages well adapted to mutuality in games, music,

dancing, tennis, and riding, and there were also the several young geologist assistants, tutor, and governesses.

We had longer or shorter visits from without. A long visit from Langley has left a lasting memory on us. His endless range of sympathetic interest endeared him to children and grownups. He was then evolving the laws underlying the flight of birds, and their application to aviation. He made objects of paper to imitate the motion of the boomerang, and others to sail straight ahead or in curves. He introduced the children to the flying of giant kites. He showed them how to see the spots on the sun by projecting an image of its disk through a pinhole in a sheet of cardboard onto a white paper screen. Hardly a day passed without something done for their instruction through amusement. This side of Langley's lovable nature was more strongly expressed when, immersed in administrative work and in problems of solar physics and in discovering the laws of flight, he could unbend to make the Children's Room in the Smithsonian.

Writing of Langley recalls an anecdote he told either at Roseland or later when with us in New Hampshire. When he was leaving the weekly reception of a well-known lady in Washington, his hostess said: "I'm so glad you came, and I hope now you will always come. Please bring your friends —that is, any who are presentable."

Newcomb came and his visit ended sooner than he intended, or than we wished. After receiving a letter he had for several days been very abstracted till walking one evening with my wife he burst out: "I've got to go. While I'm away they've worked up a marriage of number three. Number one's gone, and now it's number three." He spoke of his daughters in old Roman fashion by their numbers. He admitted that it was a very good match.

Newcomb contributed to Roseland a gigantic sun-dial by which the progress of the shadow of a tall pine tree was

marked, in hours and their fractions, along the walls of the row of houses.

George Gibbs, then forging his way towards his present eminence in engineering, came to ask me to organize a plan for the exploration for iron of a part of the upper peninsula of Michigan, to be traversed by the St. Paul Railroad.*

Roseland had its share of wild animal life. Deer often appeared in the fields and there was a large swamp in which grew a forest of high trees with open water between them. It was a heronry and densely occupied by these beautiful birds, who at our approach, if we came to its edge near sunset, would rise from a thousand nests.

Rattlesnakes abounded, both great ones and the little ground rattler not much larger than a lead pencil.

When we came in the autumn we always bought a large number of chickens and turkeys for the winter, enough to allow liberally for nightly visits of colored deacons and for the amorous nature of the wild turkey-gobbler; and very interesting were his ways. Approaching our flock by his tame relatives, he would spread his feathers and, strutting like a peacock, make himself so irresistible that the hens would abandon their own lords and follow the charmer to the wild life of the forest.

But the most interesting animals were the beavers. Before we came none of these had been known in the region. When we arrived the second autumn we found that a colony had

* The plan as executed comprised a topographic and geological survey. The blazed lines of the old government survey running north and south and east and west a mile apart were still traceable with the section corners and half-mile stakes. We sent parties with engineers' levels to make profiles running east and west on these lines and to set up bench marks showing altitude every eighth of a mile. Then compass men, each equipped with a dial compass, dip-needle and aneroid barometer, and accompanied by a geologist, moved due northward a quarter of a mile apart, noting variation and dip of the needle, and studying the geology. From this survey there was made rapidly and at small cost a good topographic map showing contours of elevation, and geological features as well as lines of magnetic attraction due to presence in depth of iron bearing mineral.

dammed a creek, and was in full activity. One day in the rainy season I rode that way and found that some distance above the dam some water had overflowed from the creek and in a very shallow stream was following in a slight depression to empty into another channel. The beavers had noticed that it ran through a group of sweet-barked pines that they evidently liked. In order to float logs of this pine to their lodge-pond they had built a mud dam about 100 feet long to back up the water of this temporary stream. They found they had built the dam so far down stream that it could not impound water to the height necessary for connection with the lodge-pond. So they had abandoned that dam and had built a new one at the proper point and had dug a canal, and in it floated many logs.

In time there dawned on us the farther wisdom of the beaver choosing the place for their colony. The creek ran through a great cornfield. They evidently liked corn, stalks and all; it was good and nourishing, and it was easier than trees to harvest. And the number that liked it grew so rapidly that one year they ate up an acre of it. So in planting we allowed for the beavers as long as we kept Roseland.

One day in March of 1893, as we came out from dinner, we saw some smoke coming out through the shingles on the sleeping-house roof. The smoke grew in volume. The well was dry, and our water came in barrels from the Bainbridge artesian well. There was only one full barrel, and this the tutor rolled to the ladder. It was kerosene. In the meantime flame followed the smoke. Rushing upstairs to where I could look down between the roof and the ceiling, I saw that the fire was starting in a large rat's nest between the rafters. A pailful of water would even then have drenched it. While I looked, the fire spread like a flash in the structure of fat pine, and in thirty minutes all the three houses were in ashes.

The more valuable things were saved. Margarita, who was down with typhoid fever, was got into safety. Pauline, being an invalid, was sent off to the Brooks's. Then to my delight I found that the two well children were showing character. Raphael, eleven years old, abandoning his own treasures, saved the government instruments; and Elise alone saved the trunks and clothing of the servants, who were getting out our things. The houses burned so quickly that we had less than fifteen minutes for saving.

It is an interesting coincidence that the previous day Pauline had seen a rat carrying a box of parlor matches up the unceiled wall of her room on the ground floor.

I must pay here a tribute to the honesty of the colored population of Roseland. Our things were scattered far and wide, but for days the colored boys and girls and older ones brought in articles of jewelry and other things they had found. As far as we knew the only thing that was stolen was a cheap celluloid hand-glass. Two negro youths fought over this, and one was killed.

For the rest of the season we lived in the log house at the gate.

My boy Raphael W., who was now eleven years old, had, with his tutor, ransacked all the neighboring localities for fossils, and longed for new ones. The rocks near us belonged, speaking from memory, at or near the base of the tertiary formation. They had a very gentle inclination to the south; so that in traveling in that direction one crossed, one after the other, the younger members of the tertiary, up into the beds still forming in the Gulf of Mexico. Because fossil hunting was a fascinating sport, and because the boy was a close observer and knew all the local forms and their visible characteristics, it seemed a good plan to let him collect gradually all the way to the Gulf of Mexico, and get some idea of the changes in life, from the extinct forms of our own

older rocks to the living animals which we would dredge from the sea. The Chattahooche River was to be our route, because it offered beautiful sections through the formations.

We took two rowboats, one for Raphael W., the tutor, and myself. In the other was the camp equipment, dredge, and supplies; also George, the negro cook. George was a good servant and, incidentally, he had recently finished a term for effectually carving up a successful rival in his wife's affections.

The trip was a success, for the boy, his geologist-father, and geologist-tutor collected abundantly for a paper on the subject. It was also an idyl in adventure. Day after day, in the balmy air of a Southern March, we floated down the broad river, through an almost unbroken primeval forest with only rare signs of the existence of man, camping wherever twilight found us.

At Apalachicola—the quaint fishing village at the river's mouth—we sold the boats, and, hiring an Italian pilot and his pilot-boat, we sailed out about forty miles to Dog Island. Here a curious thing happened. A school of small fishes was chased so fiercely by some big ones that two of the latter actually landed on the beach just in time for Raphael to kill one of them with the stick he carried. It was a fine Spanish mackerel.

We were not destined to do much dredging. In the evening the pilot called my attention to the fact that there had been since noon no change in the level of the sea, and pointing to a star, he said: "I don't like its strange color." I think that through the night there was no tide, and the pilot said we must get back to Apalachicola before a hurricane arrived, for the low islands offered no shelter.

A slight breeze had brought us along the north shore of St. George's Island when the storm broke upon us. The pilot and his helper managed to secure the sails; only a little bit

of the jib bellied in the wind. The boat drove like a torpedo before the storm. Soon the air was so full of spray raised by the wind that we could see but a few yards away. The pilot stood at the wheel. With an empty pipe in my mouth, to show the calmness that wasn't in me, I faced him.

"We have one chance," he said. "We're all right on the water before the wind, but we must strike the mouth of the river. I think the wind aims straight there."

Below me in a berth on one side lay Raphael, too seasick to be frightened; and on the other side, the tutor, too scared to be seasick. Bilge-water deluged them alternately from starboard and port. Looking forward, I could see black George in the galley, his face livid with fear. Suddenly the helper shouted from the bow, and crawled back to the pilot. His master had just time to say "Damn fool," when the spanker-boom broke loose and carried pilot and helper overboard. But they both caught hold of the sheet, and were brought back by another lurch of the craft. I feared the release of the wheel might have changed the course held by the pilot and leave us in dread uncertainty, but I suppose the bit of jib held us before the wind. Suddenly our bottom grated on an oyster-bank and we flew past a low row of high stakes. For the first time the pilot smiled: "We're going right if we can hold this course."

For two and a half hours, under bare poles, we flew before the gale and straight into the mouth of the Chattahooche River and onward several miles up stream. Suddenly the gale stopped short. Before us the sky presented a great gray arch. The dead calm was ominous, and the pilot got the boat under a cliff in a bend of the river, and waited—how long I don't remember.

Then, without warning, the gale blew for over two hours with the same fury from the opposite quarter. The dead

calm had been the dead center of a cyclone, which in its course northward wrecked villages in Alabama.

We returned to Bainbridge on a steamboat, whose cargo consisted of cases of "Best Kennebec Salmon"—one of the industries of Apalachicola.

This was the end of our eighth winter at Roseland, and was destined to be our last as far as my family was concerned, although in later years, after my serious illness, we yielded to the call of its balmy air and sunlit pines.

Fishing for Alligators with Girls for Bait

One of the visits often comes to mind. Early in January (1898), while in a mine eleven thousand feet above the sea, I was seized with a severe chill. Getting to surface and onto my horse, I managed to ride in the intense cold three miles to Cripple Creek. Now out there, and at such altitudes, a chill may mean pneumonia, and generally death; or you may thank your stars on finding it to mean typhoid fever. It took the doctors twenty-four hours, I think, to decide on typhoid. In the meantime, my samples had been analyzed as a basis for my report, and that report had to reach my Eastern clients within a week. I had to force the doctors to let me dictate the despatch. It took all day, for I kept dropping off, and had to be revived with strychnine. As soon as they dared to they moved me down to the Antlers Hotel at Colorado Springs, where I spent lonely weeks in bed.

One day I heard some one in the next room say: "It's a flat formation." That was all, but it told that the speaker was a geologist. Before long, through the door entered Clarence King. Whether in gay mood or serious, King's presence would restore any one, and in a week he had me well enough to go to a better climate. I had let no word of my sickness reach my wife, and so I chose the climate of Roseland, and had difficulty in persuading King not to

RAPHAEL PUMPELLY WITH PAULINE, ELISE AND PEDRO, ROSELAND, 1889

leave his work to go with me. On the way through Texas I read of the destruction of the *Maine*.

Roseland was a wonderful place to recuperate in. In 1893 Dr. H. P. Walcott had sent Alfred Brooks, then a student in Harvard, there to die in an "advanced stage of Bright's disease." In a few weeks Alfred was on horseback rounding up the cattle. Raphael went there to recover from typhoid, and my brother from pneumonia. So I went there, and was welcomed by the Brooks family, and promptly got well.

The two Brooks girls, Hildegard and Mary, and their cousin, Agnes Walker, were to me as my own children, and were the very best of company. We spent the days on horseback, and on one ride stopped above a cliff overhanging the Chattahooche River. Far below us a long raft of timber was slowly floating on its way to the Gulf of Mexico. Suddenly one of the girls said: "Oh, how lovely to float on and on down through the mysteries of the river and forest!" Another cried out: "Let's do it! Won't you take us?" I knew Major Brooks wouldn't allow it, so I promptly agreed. But the girls were in earnest, and I falling in with their mood, we rode to see the maker of rafts at Bainbridge. He was agreeable. "I've a fine raft going in three days from now. It's four hundred feet long, of square timber, and the top is four inches out of water. You can rig your tents on it, and be very comfortable."

At the supper table one of the girls said in the most casual manner: "Papa, next week Mr. Pumpelly is going to take us down the river on a raft. Won't it be nice?" To my astonishment the Major agreed at once.

The raft was manned by negroes bossed by a black giant proud of the name Napoleon. A tent fifty feet from mine housed the girls. We cooked and ate in this neutral zone.

The voyage lasted through about a week of fine weather—we moored to the shore at night. And what a week! We

moved on with the slow current, on through a forest that was ever changing, ever grand and weird in its awful silence—a silence broken only by the boundless mirth and song of three sweet voices. At night African melodies drifted to us from the negroes around their fire at the far end.

One day my three wards appeared dressed for swimming. In vain I objected that they couldn't keep up with the raft. I compromised by tying each girl to one end of a rope about fifty feet long; the other end I held in my hand. The water-nymphs filled the air with their merriment. It is well to be silent in those waters. There came a shout from Napoleon running aft, "Alligator!" I saw the beast heading fast toward the girls from the opposite shore. I pulled for dear life, but the girls were saved only by Napoleon who shot the alligator straight in the eye. The skin is still treasured. There was no more fishing for alligators with girls for bait.

The Italian pilot took us from Apalachicola on a cruise to St. Marks and the railroad, stopping over the same oyster bank that we had scraped during the cyclone in 1893. Here we had our fill of oysters fresh from the bed and opened by the crew.

No home is perfect unless it can hand down a good dog story, and Roseland offered one.

Pedro was a shepherd dog with a pedigree back to the vanishing point. He was also black and tan. I came to his kennel at eleven o'clock in the last minutes of a bench show. I had come into the show to kill time. I didn't want a dog, and none had interested me, but as I was passing by this one he came forward appealingly and wagging his tail. His owner asked: "Won't you buy him?" I glanced at the price on a card, $10,000. I said I wasn't looking for dogs. "You're my last chance!" he answered. "You can have him at any price, for we moved to-day from the country into a tiny apartment in a flat where no dogs are allowed."

Pedro had herded sheep, and later chickens and geese. Recently he had taken care of the baby. This settled it. We, too, had a baby, so Pedro was adopted into the Pumpelligens and followed its fortunes and wanderings.

Several years after this, in leaving Roseland to go to the North, we drove the three miles, and took the train at Fowltown. I chained Pedro to the bars of a window in the baggage car. Soon after starting the conductor came forward to tell me that my dog was gone. He had jumped through the window, leaving his chain with the collar hanging outside; and since the single-track road ran in a long cut with steep banks, he must be dead.

At Savannah we found a telegram: "Pedro came home. Will send him North with the horses."

The story came later in letters.

Pedro had gone home and, not finding us there, had gone to Bainbridge, five miles away, and looked for us in all the shops and places where we were in the habit of going. Then he had come back to Roseland and lain quiet till the next morning, when, at the right time, he met the eastbound train. He went through the cars from front to rear, and then back to Roseland. Now Roseland lay between two branches of the railroad, and we had usually gone from Bainbridge on the other branch. The next morning Pedro went there and searched for us through the eastbound train. Then he gave in, and came North with the horses. The fame of Pedro's intelligence was for years a tradition among the trainmen of that railroad.

One evening my wife found Pedro ensconced for the night in her room. She said to him: "No! No! Pedro, you must go out." He seemed much hurt. The next morning, and ever after, he was missing. Far and wide we followed false clues.

On one of these my wife and I drove for several days into

northern Florida. I remember that on this trip we spent a night at the house of a well-to-do Baptist minister. Our host, who was an old man, told us that his sister, who had been educated in Massachusetts, had been engaged to marry Wendell Phillips. It may be that his statement was that Phillips had asked her to marry him. He said that his sister was to inherit five hundred slaves, and he had always wondered whether the marriage would have kept Phillips from becoming an abolitionist. Phillips really joined the party in 1837.

The work on the obscure geology of the Green Mountains lasted till I left the U. S. Geological Survey in 1891. During these years I was, with Van Hise, engaged also in a comparative study of pre-Cambrian problems. This led to reconnoissance journeys in the southern Appalachians, into eastern Canada, and in the wild region west of Lake Superior. These are among the cherished memories of my life, both on account of the interest presented by the problems, and in their discussion with a congenial co-worker. Van Hise was not only charged with mental lightning—he was also the best of fellow travelers under all stresses. A test of this remains in memory. One night, on the shore of Lake Huron, we spread our blankets in large glacial grooves that were smooth as glass and sloped toward deep water. It seemed a good joke, this sleeping in a bed that had waited for us through uncounted millenniums. Alas, we woke in a torrent of water and amid the roar of thunder above and of waves in front. We were also buried under our fallen tent.

The International Geological Congress was held in Washington in 1891, when, probably because I was supposed to speak French, I acted as vice-president. After the meeting, Mr. Rhinelander having generously loaned me his private car and made traffic arrangements, I took on a long tour the directors of four European surveys—Reusch (Norway),

FOUR DIRECTORS OF FOREIGN GEOLOGICAL SURVEYS, 1891

Group with the directors of the Swiss, Russian, French, and Norwegian Geological Surveys.

Tschernicheff (Russia), Schmidt (Switzerland), and Barrois (France). Mr. Frederick Rhinelander, Jr., and Van Hise completed the party. We showed them the critical points in the geology of the upper peninsula of Michigan and its iron and copper regions, and important points in Canada and the Green Mountains. As we could be side-tracked whenever we wished, there was plenty of time for observing and discussing, at these illuminating points, some of the most obscure problems in the early geological history of both hemispheres.

CHAPTER L

EUROPE

After six years of Government employment, I found myself heavily in debt, and land-poor. The forewarnings of the panic of 1893 discouraged professional work. When I found that, even at a great sacrifice, I could not raise money to pay debts, we sailed for Italy. Everything I held in trust was safely invested, but the strain of my private affairs was intense, and my nights were sleepless. After the first night at sea I realized that nearly every one I knew was in the same fix, and that I had done all that was possible in the matter. Fortunately, too, I had the habit of throwing off anxieties as long as no remedies were available.

It worked all right, for when we came home, after two years absence, I found myself better off than before. Banks had dealt kindly with their old customers.

Incidentally, the enforced economy was a lasting education to the children. They fell in with the scheme at once, and from being spendthrifts they became strict mentors. The question of spending a nickel was to them now a matter for grave consideration.

On going out we had staterooms on the lower deck of the N. German Lloyd steamer *Fulda*. I learned later that on the westward voyage this first-class deck had been used as a hospital for the steerage. Before the end of the voyage influenza appeared, and at least one case of small-pox from our deck was landed at Naples. On landing both our Pauline and I came down with pneumonia, a fact that was to influence all our movements for two years.

Three months were passed in Capri, where Pauline, now fifteen years old, was down with severe attacks of an obscure fever. Through it all, in her determination to profit by being in Europe, she read Roman history, while Elise was chiefly occupied in making and applying mustard plasters. Our chief friend was old Doctor Cerio, who, like many good Italian physicians, besides keeping up with modern medicine, held on to many of the good things of the older school of treatment and nursing. He was also a good naturalist. He lived in what had once been a medieval palace, and here had filled the great rooms to overflowing with objects more or less related to natural history, into which he put all his earnings. He could not be made to take more than five francs for a visit, and insisted that most of his comings were only friendly calls.

Margarita painted, producing a remarkable portrait of an attractive Capri girl. Elise studied the guitar. Raphael explored caves and precipices, and was not happy till he had collected specimens of every known, and some unknown, varieties of land shells of the island, many as small as the head of a pin. He was now twelve, and seemed to be in a bad way as regards education. About the only kind of formal instruction he had submitted to had been a course in the "Inventional Geometry"* by the father of Herbert Spencer, which Raphael now often says was the foundation of his education.

So since the boy wasn't inclined to learn a language, I

* This is a primer that every child should be blessed with before the ordinary teacher, or school, has a chance to show how unnecessary it is to do any thinking. The primer consists of some 300 or more questions and no answers. The child, having easily answered the first question, can with a little thought answer the second, and so on to the end. Provided with ruler and divider, the child, in answering these questions, constructs all the problems in plane and solid geometry, and gets a training in logical thinking and in visualizing. I introduced the primer to the head of the Bainbridge Academy in Georgia, and the next year he told me that it had been the delight of the whole school. Only one or two children had failed to answer every question.

started him in Wentworth and Hill's Advanced Arithmetic, the only one I had, and intended for boys of fourteen. We were to study it together. It was a great success, due largely to the habit of concentrating gained in the course in Inventional Geometry, and of thoroughly understanding every step before trying the next one. He scorned the rules, and was generally two or three problems ahead of me. This was all the formal studying the boy had during the year, but he mastered the subject.

Pauline's fever lasted from two days to a week, with intervals of two or three days. We decided to use one of these intervals to begin the journey to join my wife and Margarita in Florence. So, early one sunny morning in April, we were in a sailboat ready to go to Sorrento, but Pauline, not having seen the Blue Grotto, turned us thither. This was nearly all she ever saw of Capri. Then we sailed to Sorrento, and drove to Pompeii, there to pass the night. Here another attack of fever kept us several days; but how wonderful were those days! The little Hotel Suisse, then a modest inn with a kindly host and service, had a small second story where our rooms opened onto the broad flat roof of the story below. And what an outlook! Beneath the dome of a soft Italian sky lay the calm blue bay, its islands and encircling shores and hills, its cities and villas all languid in the glow of sunshine. At night in the light of the full moon the scene was weird. Near at hand rose the old wall and sea gate of the dead city and beyond, on the left, towered the firelit cone of the volcano. Imagination saw reënacted the great tragedy, the deafening noise, overwhelming torrent of mud, and the crowd fleeing across the plain under the rain of bombs and ashes.

The moment the fever had gone Pauline, knowing on how slender a thread hung her life, and believing this to be her last chance, insisted on being carried through the ruins. Her

joy and intelligent interest has always since then remained to us a bright memory of her short life. This and that we were able to show her one spot where kind Nature gave relief from the general impression of desolation and tragedy: what two millenniums ago had been the garden of a house was now all aglow with a brilliant mass of poppies.

Going from the ruins straight to Rome, a respite from fever gave Pauline a chance to see especially the remains of the ancient part of the city, and to get to Florence and join her mother and Margarita.

We stopped at a pension kept by two ladies, one a Pole, the other a Russian. Among the guests was a Russian judge with whom I had many interesting talks. In one of these—about Russian Criminal Law—he told me about a trial at which he had been present. A princess had educated and brought up in her family the daughter of her coachman. The son of the house, returning from the University, had fallen in love with and seduced the girl, who was then driven from the house and became the young man's mistress. After a quarrel he abandoned her. Left penniless, she drifted in the underworld of the capital. Several years later the young prince, then engaged to a princess, was summoned to sit on the jury. In one of the cases a woman was being tried for murder. As the trial went on the prince suddenly knew that the wretched being he was trying was the wreck of the beautiful girl he had betrayed. There came over him a wave of conscience, a crushing sense of his own responsibility. When the trial ended with her conviction, he had already decided to get her release, to marry her, and devote himself to restoring her to a normal life. When he came to her in the prison, she refused to subject him to such ignominy.

I have forgotten how the story ended, but I have a vague impression that while he was still trying to persuade her she fell ill and died.

That same evening, for the sake of Pauline, I wrote down the story as I had heard it. Months, perhaps years, later my son-in-law sent me a copy of the *Atlantic* with the first chapter of "The Awakening by Tolstoi"—the beginning of *Resurrection*. I have not read the book, but I have the impression that he changed it in the matter of the woman's death, in order to show in an individual instance the power of an awakened conscience in molding a life.

Moving northward by stages, we stopped at Bologna, Milan, and on Lake Como, at each of these places stopping long enough for Pauline's fever attacks and the intervals in which the invalid could enjoy what she might be able to see. At Lucerne we stayed two months more or less, or until the physician, declaring the fever was malarial, had disordered the brain with continual doses of forty grains of quinine. Then we went to Grindelwald.

I wanted Elise and Raphael to have an experience in the high mountains—not to waste effort in climbing to the top of a peak but to have a sunset and sunrise from an Alpine Club hut 8,300 feet above the ice fields.

With guides and a rope, we made our way up the lower glacier around an ice wall, and across the *mer-de-glace*, and before night reached the Alpine Club hut near the foot of the Schreckhorn. This was built as a resting place from which to begin, after midnight, the last stage of climbing the peak. Along one wall was a platform about seven feet wide, long enough for nine sleepers, and covered with straw for mattress. There were many blankets and a stove. The guides carried some food and pieces of wood. There was no caretaker.

After a brief rest, we went out and sat on the rocks as on the "Seats of the Mighty." In a half-circle around us towered giant peaks—the Schreckhorn, Lauteraarhorn, Agassizhorn, Finsteraarhorn, and Jungfrau, and the lofty crests

from which they rose. Below us stretched out the great "sea of ice" coming from snow-filled *cirques* under the peaks, and, as a glacier, winding far away to the lowlands. Everywhere ice and snow and lofty peaks and crests—all glowing with the divine fire of the setting sun. As the coloring faded there came from somewhere the echoes of an avalanche. Then a new silence—the silence of eternity in space, boundless space of the starlit universe. And as we sat a faint light rose above the eastern crests and slowly the moon lighted up a phantom world—the Wallhalla of the giants of the ages.

We were up betimes to see the change from night to dawn, and the red spreading along the snowy heights. And as we looked far below us, lo a herd of chamois, aroused by the call of the dawn, was scampering over the *mer-de-glace* to seek its pasture.

The remaining nine months of our stay in Europe were, even more than before, given up to the care of the invalid. In Paris dear old Dr. Alan Herbert's diagnosis was given with an English common sense dictum: "Malaria? Fiddlesticks! Pneumonia? Nonsense! No more quinine; no more plasters. We'll watch and learn." The brain quickly cleared, and the patient improved, and Dr. Herbert ordered us to get Pauline quickly to Biarritz.

Margarita had been engaged for seven years, and as Harry Smyth had come over, they decided to marry in Paris. Then we found that the law required residence of six months or six weeks, I forget which. We consulted two French lawyers. They were obligingly casual. Each said: "It's true you've only been here a week, but it's very simple. You've only to give your *Concierge* ten francs; he will swear you've been here six months. *Voila votre affaire.*"

As the lovers objected to beginning married life with a lie, we went to Brighton, where English law required only two weeks' residence. After the marriage they went to America,

and the rest of us went to Biarritz. Here, after we could find no suitable apartment, the agent showed one which no one would take because of a case of typhoid fever in it two years before. Maison Nartus stood on a promontory and faced the ocean. It was the gem of Biarritz. The rooms were large and comfortable. The landlord had been the *chef* of the King of Spain. I was delighted. My work for the National Board of Health had shown that no danger of typhoid fever lurked in sewer gas. The landlord also was delighted, so much so that he gave the five of us the best floor for forty-three francs a day, everything included, and all meals in the apartment. We were served royally and kindly through the months of our stay.

We made here some agreeable acquaintances, English, Scotch, and Americans. Among the English were the Hon. Lionel Tolmache and his wife, the Hon. Beatrice. By a curious coincidence Mr. Tolmache was born in the same year as I, and his wife in the same as my wife; and the year of their marriage coincided with that of ours.

Mr. Tolmache was an essayist and an author of books full of character sketches and anecdotes of well-known Englishmen. Mrs. Tolmache wrote good poetry.

It was a Godsend to have, through a winter, an acquaintance who not only was widely interesting, but was also as glad as I to have some one to talk with.

After Biarritz we had a pleasant March at Cambon, and a drive in the Pyrennees. In these mountains we were among the Basques of Spain. They are peasants, but were all ennobled by a former King. Their arms are blazoned over the entrance to the houses; but in one a pig, his forefeet resting on the window-sill, stood gazing upon us from the second story. Then we drove through Touraine, beginning with Chinon, the most beautiful of ruins, and ending at Amboise. At Chenonceau we had an example of how dif-

ferent is the treatment of visitors to famous places that have been bought by Americans from that shown by their French owners. We were very rudely driven away from the bridge at the entrance of Chenonceau, which now belonged to a rich American. On the other hand we were courteously shown through the chateau of Azay-le-Rideau, although the family were at home, and on leaving were told to wander at our leisure in the park, as if we were at home.

After visiting the chateau of Amboise, and while waiting at the station for a train to go north to Blois, we fell into conversation with an Abbé who was on his way south to Tours. My wife talked with him of the pleasure we had found in loitering through Tourain and in the ruins of Chinon and Loche. The old Abbé had a rare charm of manner, so my attention was arrested when he said: "No one visits Limeray, where I live, although it is full of historic interest." When I asked whether the town had an inn, he answered: "No; there are no accommodations for your party." Then he added, "There is only an old castle of the twelfth century that belongs to my brother, and that is at your service. It is true that it is haunted. My brother and his bride lived there only a few weeks, and were driven away by the ghosts, but the furniture is still there."

When the children heard this they shouted: "Oh! a haunted castle! Wouldn't it be delightful? Let's go there." So I said: "*Mon pere,* will you be surprised if we accept your invitation?"

"It would delight me," he answered. "It's true I am expected at Tours, but *n'importe,* I will conduct you." So we were soon at Limeray. There were no public carriages at the station, and, as the walk of two miles would be too much for Pauline, the Abbé introduced us to a countess who offered a seat in her victoria.

We made an odd party, following the priest among the

curious crowd that watched us as we passed through the village, the priest saying to his people:

"Yes, behold these brave travelers, you who are afraid of the castle and of *les revenants*. They are going to sleep there to-night."

He got together men with wheelbarrows to carry blankets and loaves of bread, and, with this added touch of picturesqueness, the procession finished its pilgrimage. The castle had been partly destroyed in the wars, and restored in later centuries. We arrived at the foot of the old tower. The Abbé opened a door in the tower, and took us up winding stairs to the roof, from which we looked beyond the meandering river, over the soft landscape of Touraine seen in the light of the setting sun. To enter the chief part of the castle we had to return to earth and, before reaching the main entrance, pass by a great iron gate into a large walled inclosure, now grown to a wild tangle. From the roof, high above the portal there rose an iron staff, around which a life-size figure of a crusader protested loudly against the ignominy of eternal torture. Entering the now dark hall, the Abbé lighted a candle and ushered us into a room so large that its limits showed vaguely in the flickering light. A group of awe-struck peasants of the estate brought an omelet and a pail of goats' milk, to which our host added two bottles of choice wine from the cellar. Then, placing the lonely candle on the dust-covered table, the Abbé, pointing to two faintly visible doors, said:

"There are two rooms with beds for three persons, and on the floor above, which you can reach only by way of the tower, there is a bed which once belonged to Guy de Maupassant." Hearing this, Pauline cried out: "Oh, I want the bed of Guy de Maupassant."

As soon as my wife and two children were in bed I took the blankets and the only candle, locked the outer door, and

with Pauline went out and around to climb the tower. The door shut with an echoing bang. The light went out, but, renewed with the aid of the last match, it guided us up the deeply worn steps to where we found the bed. That bed might have given de Maupassant many wakeful hours to visualize his plots. It was in a long room with a large window with small leaded panes.

From an adjoining room, so big that the dying candle barely lighted the way, I stumbled over a tattered carpet which, brought to near my daughter's bed, served me for mattress and cover, while shoes and coat made a pillow. Once composed in the silence, there came over me a wave of remorse at not having yielded to my wife's objections to opposing to such a risk a child with a serious heart trouble. Even then there came the sound of voices, and Pauline, startled from sleep, cried excitedly: "Oh! papa what is it, *what is it?* They're ghosts."

"Now Pauline," I answered, "there aren't any ghosts. Just go to sleep. Remember that the wind can make all sorts of unearthly sounds. It can howl and cry and groan and imitate voices. Whatever you hear, remember it's the winds around an old house. Now go to sleep, darling, and have as pleasant dreams as I mean to have." And she slept sweetly for the rest of the night.

I knew then that I must stay wide awake all night, to be ready to compose the child if she should again be frightened. I had never been in a haunted house. I confess it was uncanny. I knew there were no ghosts. My superstitions had gradually resolved into the desirability of putting on first my left shoe and the left branch of my trousers, and knocking under the table to ward off the unwished for.

Generally before dropping off to sleep I have visions—scenes or faces. Mine are almost always agreeable visions. If I notice them much they vanish and I stay awake. That

night faces came that were hideous. They came often. Sometime in the night there came the sound of heavy tramping on the stone floor. It passed by me and stopped beyond. Then I heard the clanking of metal objects on the farther wall, then again deep silence. I sat up, but there were no matches with which to make a light, and Pauline had not awakened. Had I dreamed. I thought not. In the dawn I opened the window in the next room, and looked out just as Elise threw open the shutters below. When I made a noise she jumped back in terror, and I knew there had been experiences on the ground floor. Pauline woke up refreshed and happy. Raphael had never waked through the night. Not so Elise and her mother. They were comfortably assuring each other that ghosts were only good to tell of by dim candlelight for the sake of thrills, when there came a resounding crash. They consoled themselves by saying that I must have dropped something heavy above them—which I had not done. In the night her mother heard footsteps and the rustling of gowns.

Taken as a whole, the haunted house had been a success for thrills. Had it been so as to the reality of ghosts?

Later the boy's mother saw a letter written by him to a Scotch girl sweetheart, in which he said he hadn't heard or seen anything, "but the next time he should be in a haunted castle he would sleep upstairs where the bulk of the ghosts were."

In the morning the Abbé came with some cow's milk, and invited us to mass. The service was in an interesting Romanesque church. The Abbé himself had modeled, along both walls of the nave, a dado, about six feet high, of cement, I believe, showing a procession of saints in life-size and in high relief. After mass he invited us to an excellent and very welcome breakfast. As we parted, with his blessing, he said that he was sure we, though of different faiths, should meet in heaven.

I passed the years from 1895 to 1902 partly in professional work in the far West and partly in exploring for iron ranges on Lake Superior.

As my agent had let the Dublin house the whole family crowded into one of the cottages on the place, the children and their guests sleeping in tents, while my wife and I were down—she with bronchitis, I with broncho-pneumonia. In the autumn of 1895 our first grandchild—Charlotte Smyth—was born.

I had arrived in America in the midst of the depression that had begun in 1893. There was no promise of professional work in my line.

There being nothing better to do, my son-in-law, Henry Lloyd Smyth, and I decided to explore both for gold and iron ore.

This led us in many trips through northern New England, Canada, the Black Hills, Colorado, Nevada, and California. The work was very interesting, generally disappointing, and often very rough. In all cases we broke down samples, often a quarter- or half-ton, from outcroppings or in prospecting openings and, seated on the ground, I spent hours hammering these samples between my knees down to a half-inch size and repeatedly quartering them down to a small sample for assayings to get a proper average of the ore. I think I was, in 1870, the first to use this method of valuing a mine. Sometimes we took one or two of Mr. Smyth's mining students who volunteered for the experience.

During the five years to 1900 we found only three promising properties. In two of these cases the gentlemen who had subscribed to the venture canceled their commitments, one of them because of the Venezuelan proclamation. The third was a serious failure. It was a mine carrying a thin vein of immensely rich ore. Friends had advanced money on a lease. The miners stole practically all this rich ore, not less than 200,000 dollars' worth. We kept a detective in the

mine who betrayed us. We knew the ore was being stolen and were powerless. The miners were of the Western Federation, and, as it happened just after the bloody strike when Waite—Governor of Colorado—favored the miners, no one dared to search them. This ended my predilection for extremely rich gold mines.

I have generally managed amicably to avoid being interviewed. This has, however, not prevented the publication of wholly invented interviews, especially when the reporter's object is to boom his town. One memorable occasion comes to mind. On my first visit to Cripple Creek by train I had quickly risen from an altitude of 6,000 feet to one of nearly 11,000, adding greatly to the apparent weight of my legs, and to the effort of walking to the hotel. An enterprising reporter, who had watched my registering, accosted me: "Mr. Pumpelly, would you mind telling me how you like Cripple Creek?"

"I have only just come from the station," I answered.

"Well, how do you like what you did see?" "My eyes were glued to the boardwalk, and that seemed too narrow for a town full of saloons." "Were you ever in a mining camp before?" "Yes." "Well, how does Cripple Creek compare with those you have seen?" I laughed: "Oh, it overtops them by—several thousand feet," and I went away. The next morning some one gave me a Denver paper containing an account of the interview by its reporter.

A Scientist in the Camp

"Rachel Pompelly has arrived in Cripple Creek. He is the author of several books on Egypt. He is about ninety years old. He sports a gray beard that reaches to his knees, and in his get-up he closely resembles Rip Van Winkle."

If I had got his name I would have recommended him to Mr. Paul Dana as a valuable acquisition for the *Sun*.

While we jointly, and I personally, had had eminent success in exploring for iron ore before 1893, it was not so in these later attempts north and west of Lake Superior.*

Once in Denver I saw chunks of turquoise and opal. I bought some of each and had them cut to mount for my wife. Then I thought it would be fun to mount some myself. I had never learned the use of tools or even how to sharpen a knife. As I knew nothing about methods, except the use of the blowpipe, I began with gold wire and made a passable safety-pin. The fun was in inventing my own methods. In the course of time, after innumerable mistakes, there came success and during two or three years the work was an absorbing pleasure.

I began to be rather proud of my products, but one day my artist friend, George deForest Brush, took me down. I had confidently shown him the clasp for a side bag. It was of silver incrusted with rubies.

"Oh, that's nice," he said. "Tell me, did you cut those out of a sheet of silver?"

"Y-e-s," I faltered.

"And did you use drawn wire?"

"Y-e-s."

That was all. I hated the work, but I had learned a lesson. Why hadn't I thought of forging the parts from ingots to have it all hand work? It took some time to learn the secret of lengthening, widening, and curving on the anvil. In the end I had a clasp decorated with a vine of gold with

* These explorations, covering large areas both west and north of the lake, discovered extensive belts of an iron formation differing from that of the Marquette region only in that the jasper is banded with magnetite instead of hematite. Except at a few points there seemed to be no evidence of that replacement of the jasper bands by ore which indicates the probability of local developments of larger bodies of mercantile ore. The possibility that this condition is general, and that it was caused by a widespread metamorphic action that, before concentration of iron could occur, changed the original iron-bearing mineral bands into the insoluble magnetic oxid has discouraged further search for workable ore bodies.

little sapphires for berries. This won praise from the artist.

Once when William James caught me at the work-bench he asked: "Is this rejuvenation or a sign of senility?"

I answered: "In its bearing on the æsthetic demands of my family it is pragmatism."

At fourteen a desire to give shocks to the maids in our service had aroused in Raphael a longing to have an electrical machine. He succeeded in the matter of shocks by means of a useless medical battery which he had to restore without help. Then, having seen through the glass of a cabinet an electrical machine, he asked me to buy one for him.

"I'll give you money to pay for the glass disk, but you must make the rest of the machine wholly out of such junk as you can find about the house, and you must get all the information you need only out of books."

He made a good machine that gave a long spark, and in doing this learned a lot about electricity.

The next year I had him with me at a large mine in the Rocky Mountains where all the hoisting was done by electricity. While I was talking with the manager Raphael was wandering among the great electric plant. After a while the engineer who had accompanied him said to the manager: "The boy understands this whole plant about as well as I do." I mention this only to show the importance of utilizing the spark of interest to develop the flame of imagination and inventiveness in self-education.

He passed the next winter at a boarding school where he did not seem to distinguish himself in study as much as in popularity with the boys rather than with the masters.

After that he came under the influence of two excellent teachers of the Rogers High School of Newport, Mr. Leslie in Latin, and Mr. Frank Thompson in Mathematics and

Physics. There was a strong mutual liking between him and these gentlemen. They inspired him in every way except in the matter of Latin.

When he saw me working with gold and stones he began to work with silver to the loss of much time in preparing for college. In doing this he soon made silver for the table, including a small teapot. He worked with a ready facility quite beyond anything I could attain to, and made a large hot water kettle and stand which the appraiser, in making, under oath, an inventory of my house for insurance purposes, estimated at $300.

About this time, at a Saturday Club dinner, President Charles W. Eliot took a seat next me to tell me how seriously I was neglecting the education of my children.

"Yes, I'm sorry they can't go to school," I answered. "There are certain reasons why we think it more important to give them an all-year-round open-air life. They have governesses and tutors."

"Still you certainly make a great mistake, for they will lack the power of concentration that comes only with systematic training."

"I know that in my case you are to a great extent right, but my children have concentrated, and closely, in any subject that they like. Margarita in painting and Latin, Elise in music, Pauline in history, and Raphael in natural history, mathematics, and physics. What they will really lack will not be power of concentration, but breadth of foundation in studies preparatory to college."

I think we were both right, but the method I had felt obliged to follow justified itself—aside from the point of view of health—because, although the children's educational horizon was narrowed, interest and concentration in their favorite subjects gave both breadth and depth in achievement in these and improved their general outlook. Margarita, in

quiet and persistent work, has attained to exceptional excellence in portraiture.

Raphael, after being a good geologist and physiographer, turned to farming as the most rational life and in three years developed out of stump land, and almost unaided, a large and model plantation. It is interesting—in view of the conversation mentioned above—that in the fourth year of this farm President Eliot, who was a member of the Rockefeller Educational Board, wrote him that it was his duty to publish fully his methods and results for the benefit of Southern agriculture.

Raphael did not graduate at Harvard. In 1903—in his junior year, I think—he applied for permission to sail April 1st with me on my expedition to Turkestan. Professor Shaler gave the leave of absence and promised that he might submit theses connected with his travels for "makeups." My date of sailing was changed to a few days earlier and to his new application Professor Hollis, in the absence of Professor Shaler, approved of his taking advantage of the opportunity, but refused to accept the theses for "makeups." This was repeated in two more years causing him to lose three half-years. After that he wrote me: "I have resigned from Harvard. I can use my time better than in chasing a degree. I don't care enough for one anyway."

In connection with the boy's education, he was troubled about producing as a freshman his first theme. I said to him:

"Go and spend the night on Monadnock, alone on the heights from sunset through night to sunrise. Watch the unfolding of the eternal drama that inspired religions of the ancient world. Then describe it as you saw it and felt it. Present it in direct language; don't use similes.

He did this and wrote an excellent theme, and I think his ability to present his ideas clearly and forcibly is partly due to this start.

Aside from the repeated absence, on my part, on professional journeys in the far West, the life of my family was passed alternately in Newport and Dublin, a routine broken only when after sickness recuperation was found at Roseland, where we visited the Brooks. The only marked event was the marriage of Elise in 1898 to Thomas Handasyd Cabot.

TO MY FATHER ON HIS EIGHTIETH BIRTHDAY

Now Summer finds her sweets acceptable,
And every wind that harshly shook her head
Dies down; and only Love's warm sky instead
Now silently unfolds her breast, the dull
Winds whispering of charity. A lull
In Life's wild storm, the peace of Heaven spread
Upon the quiet heart of Earth: not dead,
She is creating life insatiable.

And thus art thou my Father in thy bloom!
From all thy life thou drawest now more life.
Above thy calm the fragrant rose uplifts
And every day some lesser bud gives room
To greater truth. For thee there is no strife;
Life's Regent, thou fulfillest Summer's gifts.

ELISE PUMPELLY CABOT.

September 8, 1917.

CHAPTER LI

CENTRAL ASIA, EXPEDITION OF 1903

I COME now to what was to me the most interesting part of my life. In the part relating to China I have told of my many geological excursions across much of the central Empire and its northern provinces. It was the first attempt ever made to study on broad lines the geology and mountain systems of northeastern Asia. I have also told of the work of three Chinese scholars in gathering data from geographical literature.

These Chinese scholars, after finishing the prescribed work, made some extracts that they thought might interest me from other sources, and among these on an old map there were two little notes that started a train of thought which was to develop into a far-reaching hypothesis that haunted me for forty years before I could put it to a test.

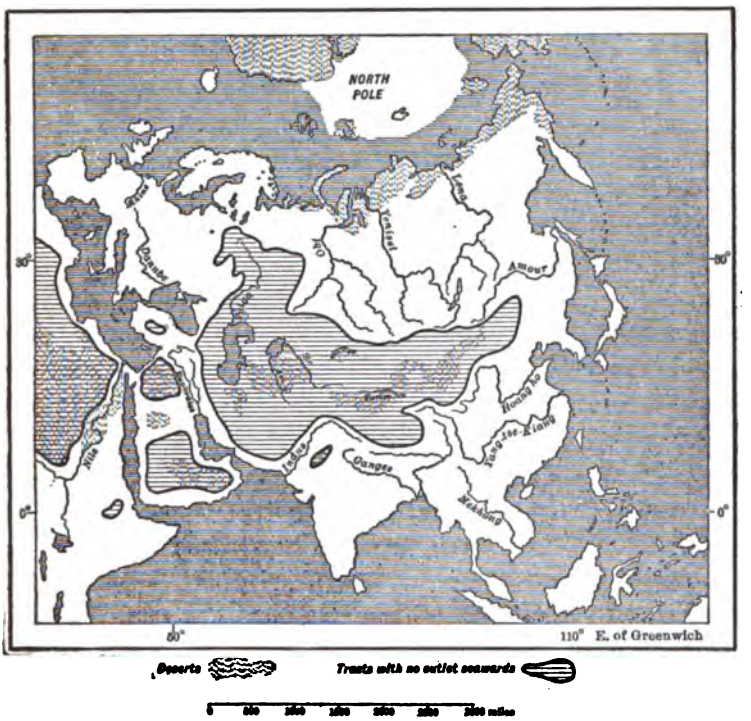
These notes were in an old commentary of one of the books of Confucius. It contained maps showing the rivers of the Empire and their ancient changes of their courses. On a map of the Tarim basin in Chinese Turkestan, at a point apparently north of Kashgar, one note read: "Here dwell the Usun, a people with red hair and blue eyes."

Another note told of the burial of more than a hundred cities by sand during one of the dynasties of the early part of our era.

I had read enough of the Aryan problem of that time to know that most of the European languages were sisters to Sanscrit and Zend, and that their cradle was supposed to have rocked on or near the Pamir. So to me the hair and

eyes of the Usun seemed to mean Aryan—a fact that was probably already known.

But what impressed me was the relatively rapid burial under sand of a large number of towns which one might



MAP OF THE UNDRAINED PARTS OF ASIA
From Elisée Reclus: *The Earth and its Inhabitants.*

assume to have had a considerable background of existence. Whence could come such a vast volume of "flying sand?" Mr. S. Wells Williams had lent me the great map of Central Asia compiled by Klaproth, and I think Humboldt, largely from itineraries of native caravan routes, and observations made during Russian campaigns in the vast desert between Siberia and Lake Aral. I was at once impressed by the

countless lakes and lakelets that were dotted over the plain between Lake Aral and Siberia. They showed neither tributaries nor outlets. I could account for their continued existence in a region of rapid evaporation only on the supposition that they were vanishing remnants of a former large body of water. By looking back we might imagine them merging into an inland sea that would include the Aral. Later when in Irkutsk I met some Russian officers who had campaigned in that region they told me that the lakes were drying up, and one that existed in the time of Peter the Great was already dry and occupied by a town. What had made a large inland sea, and why had it disappeared? The maps showed that the Aral was fed by the Oxus and Jaxartes; and the Caspian by the Volga, which drained the larger part of European Russia, and yet could not lift the Caspian to ocean level.

In a vague way I associated this and the buried cities with the Aryan problem. A great inland sea might, I thought, have produced a climate favorable to an extensive population.

Soon after I reached America I became interested in some problems connected with the drainage from the melting of the North American ice-cap, and then I thought I saw in the melting of the ice-cap that had covered Russia west of the Ural Mountains the source of my inland sea; and, in the disappearance of the Russian ice, the beginning of the shrinking.

These loosely connected facts and speculations coördinated into a dream that appealed to the imagination, not only in me but in Alexander Agassiz and Henry and Brooks Adams, and to some other friends.

Later, talking this over at the International Geological Congress with the director of the geological survey of Russia, I asked whether they had found any sedimentary deposits of the glacial period on the borders of the Aralo-Caspian

GROUP AT OSH WITH COLONEL ZAITZA AND STAFF

depression, and he replied that within a year or two, on the flank of the Ural Mountains, they had found such beds with shells of the glacial period. Then I felt that I had the data for a preliminary working hypothesis that should be tested, and I wanted to do the testing.

When I said so to my Russian friend he agreed with me, and said that his Government would detail topographers for me and offer facilities for the work.

Mr. Brooks Adams was much interested in the question. He had just written his "New Empire" to show that the fluctuation of trade routes had exerted a dominating influence on changes in western civilizations. Professor Pritchett also became interested.

To raise money we thought to form a society and get subscriptions, which seemed to be the only way open, although I disliked the idea of working under a committee. Just then Mr. Carnegie established the Carnegie Institution. Agassiz was a trustee, and he suggested that I should apply for a grant. This grant was made on the condition that I would direct the work in the field.

My hypothesis, formed in 1870, assumed the former existence of a large inland sea, and that Central Asia was the primitive home of the Aryan stock. It was to be tested by finding shore lines of such a sea and traces of early Aryan civilization. Its simplicity was attractive. Had I been an archæologist its simplicity would have frightened me, as it actually began to in 1902, after I had assumed the responsibility of making the test, for I now began to find that the Aryan question had become a violent philological and anthropological war. According to the different factions the primitive home was in northern Europe (Penka), or in northern Asia (DeMorgan); on the Hindukush (Ujfalvy); while Sergi brought the long-headed stock from the Mediterranean sphere into Central Asia where it impressed its

language on broad-headed Asiatic stock, which, in turn, after conquering Europe, superimposed it upon the then existing tongues.

I decided to devote the first expedition to a reconnaissance —searching on the one hand for traces of prehistoric civilizations, and on the other hand for evidences of geological and climatic changes during and since the glacial period.

Professor W. M. Davis, one of the fathers of physiography —the modern form of physical geography—willingly took charge of this part of the expedition of 1903, selecting Mr. Ellsworth Huntington as his assistant.

I and my son, Raphael Welles Pumpelly, gave our attention to the archæological side, and incidentally to the geology along our separate routes. The two parties were to meet at Baku.

Pauline was married on March 17th and became Mrs. James Gregg, and Raphael and I left Boston March 18, 1903, and reached Petrograd only on April 23d—owing to my having an attack of pneumonia on the way, for I came down with bronchitis in London, had a relapse in Paris, another in Berlin, and in Petrograd it developed into a serious bronchopneumonia. The doctor said that at my age and in my condition a journey to Turkestan would probably kill me. I had never backed out of an undertaking—always excepting my contract to write Holt's big text-book—and I had no idea of abandoning what I thought might be the crowning experience of my life. The doctor told me further that I must give up smoking. I didn't do this, but from that time on I stopped absolutely the practice of inhaling the smoke.

Mr. Herbert Peirce—then Assistant Secretary of State, and formerly Secretary of Legation at Petrograd—had given me letters to Russian Cabinet Ministers, and Baron Richthofen in Berlin gave me another to Senator Semenow. These and the support of the Imperial Academy of Sciences and Imperial

Geographical Society, through Tschernycheff and Professors Radloff and Schmidt, made my way easy as far as the traveling was concerned. I got, however, no encouragement as regards future excavations.

All the Ministers gave me letters to their representatives in Asia. Turkestan being under military administration, the Minister of War issued instructions—through the Governor-General—General Ivanoff—to all the officials in Turkestan to further my plans. Prince Hilkoff—Minister of Ways and Communications—was most friendly. When I asked how, in traveling by rail, we could explore between stations he said: "I will give you a private car. You shall keep it as long as you like. You look out; you would like to explore; you tell the conductor to sidetrack your car. When you want to go on you flag a train."

At Baku we met Davis and Huntington. Baku, famous in antiquity for its sacred fires of burning petroleum, is now more famous for its forest of derricks pumping oils, for having a municipal water-works distributing distilled water, and for its wickedness. While waiting for us Davis had found, at heights up to several hundred feet, shore-lines of quaternary age. To the east of the Caspian we found other traces of old shore-lines. However, Russian geologists exploring between 1880 and 1891 had definitely proved the former existence of an inland sea which included the Caspian and Aral and extended both north and east of these seas.

Crossing the Caspian at night, I was on deck before daybreak. Soon over Asia hung the changing tints of dawn, and through this mystic veil I glimpsed the portal of the ancient world. There lay the goal of heroes. Beyond were cradled nations, gods, and myths. Was not Daphne even now fleeing swiftfooted before the eager god?

Then, for the first time, I was besieged by doubts. What I had come to seek was of a time far down a long vista of the

ages. How had scores of centuries wrought to hide all trace of work of man?

The sun rose in Oriental splendor, revealing the bare and yellow shore and cliffs and rugged hills of a desert world.

Landing at desolate Krasnovodsk, where begins the Transcaspian Railway, we were pleasantly received by Colonel and Madame Volkovnikoff. The Government had detailed a young nobleman to accompany us as interpreter and to help in intercourse with officials, for in Asia, under the military police, the surveillance of foreign travelers was rigid.

Knowing that we were going into a hot and thirsty country, and that the central Asian wines were fiery and the *vodka* strong, we agreed that until we should recross the Caspian we would drink nothing stronger than tea, excepting only when invited out. We had laid in a good supply of jams, marmalade, sardines, caviar, and Swiss cheese; a *samovar* kept us in tea, unboiled water was *taboo,* and we found at all stations good bread, Russian, Turkoman, and Persian. The latter was in sheets about five feet by two, an eighth of an inch thick, and very good. Later we added a Turkoman brass soup kettle, heated like the *samovar* by charcoal burning in a central tube, and furnished with a faucet. In this we made soups and stews with meat and vegetables foraged in the local markets. For side excursions we had horses from the army posts along the route.

Of the events of the reconnoissance of 1903 I will write but briefly because greater interest attached to the expedition of 1904.

For nearly two hundred miles our route lay over desert plains, and along the base of low bare hills. Mounted on good horses we made side trips that were interesting geologically, and on which were shore-lines 100 and 200 feet above the Caspian. As we traveled eastward, after reaching an altitude of more than two hundred feet above that sea, there began

ON THE WAY TO THE PAMIR

From a photograph by Raphael Welles Pumpelly

to appear low mounds on the plain. They were known as *kurgans*—Turkish for hill or eminence. Throughout Siberia and parts of Russia in Asia a *kurgan* is assumed, from experience, to be a great pile of earth raised to hide the tomb of a chief, or to cover the burial of those fallen in battle. I wondered what interest these in Turkestan might have for me.

For two hundred miles our route to Askabad and beyond lay along the base of the Kopet-dagh, a range rising 7,000 to 9,000 feet above the sea, and forming the northern escarpment of the plateau of Persia. At the foot of this escarpment begin the vast plains of the Aralo-Caspian basin, extending to the Arctic Ocean, barren deserts as far as Siberia. At intervals streams descending in gorges from the Kopet range fertilize small oases, in which they disappear.

At Askabad the Governor, Colonel Kukol-Yasnapolski, and his charming wife entertained us. The Governor gave permission for us to enter Persia, and detailed to go with us a diplomatic attaché, Mr. Yantchivetski. This excursion led us through the high longitudinal valleys of northern Khorassan, where the population was largely of Kurds who had been brought thither to form a buffer between the Persians and the Turcomans. Until conquered by the Russians in the eighties these people, through savage raids, had kept the region in a state of terror.

A visit to the ruined city of Anau, a few miles east of Askabad, had had an important result. The place had been abandoned since 1840. We went there to see the ruins of a beautiful mosque, but near the city there rose two large *kurgans* forty and fifty feet above the plain, and one of these had, twenty years before, been trenched through from the top to near the level of the plain by a Russian general hoping to find treasure in the supposed tomb. To my delight the *kurgan* proved to be formed of the accumulated débris of civilization.

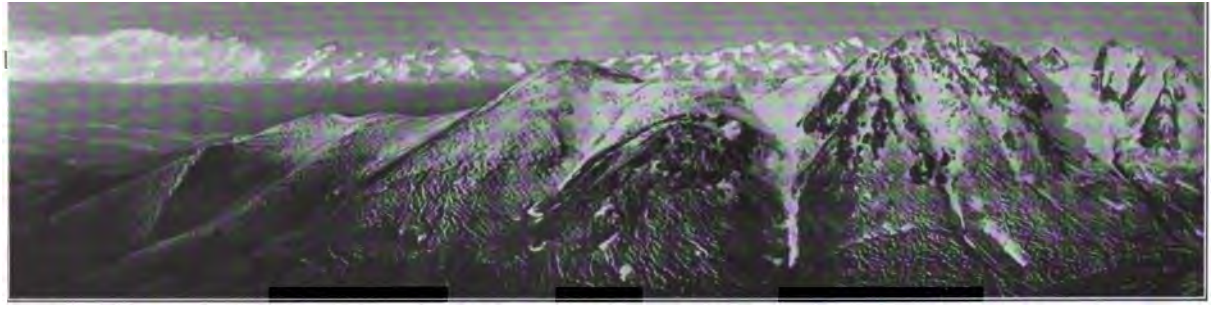
It was roughly stratified, the lower two-thirds was full of bones and of fragments of decorated hand-made pottery, while the upper third, sharply defined, abounded in an entirely different kind of earthenware.

Thenceforth *kurgans* assumed a direct interest, for I suspected that in them lay buried what I sought. They came into view on oases at the mouths of mountain gorges, or beyond on the now barren desert. They varied in height from a few yards to eighty feet—usually rounded wasting mounds.

We stopped next at Bairam Ali—Old Merve—"most ancient of cities." It stands far out on the desert, where the river Murgab coming from the Afghan Mountains spreads out to evaporate on its alluvial delta. On this once vast, now largely barren oasis, stand the ruins of two mediæval cities built of burned bricks and glazed tiles. In one of these, avenging the death of his grandson, Genghis-Khan slew its million inhabitants. Here, too, Omar Khayyam lived and dreamed a year. Not far away were others, marked only by wasted walls. From these walls we saw ancient mounds scattered over the plain and along the horizon twenty miles away.

Old Merve is now an Imperial domain with a Russian city and a large agricultural experiment station. Mr. Dubussoff, the director, kindly took us all into his house during our sojourn. One incident I remember. On the 13th of June we were at dinner when our host motioned for silence and, listening, exclaimed: "Here they come!" Through the closed windows we heard the sound of a vast swarm of mosquitoes. They had suddenly appeared to open their season of malaria. Mr. Dubussoff said their bites would be harmless until the 1st of July.

Of our visits to Bokhara and Samarcand I will write later. At Tashkent we were hospitably received by the Governor-



LOOKING ACROSS THE ALAI VALLEY TO THE TRANS-ALAI MOUNTAINS

KIRGHESE FAMILY ENTERING THE ALAI VALLEY FOR SUMMER PASTURE

General—General Ivanoff—and his wife, and arrangements were made to open the way for the independent traveling of the members of my parties. Here we split, Davis and Huntington going to Kashgar and Lake Issikul, while I, with Raphael, was going through Ferghana to the Pamir. Our route lay up the fertile valley of the Syr-darya—the ancient Jaxartes—once so densely peopled that, it was said, a cat could walk a hundred miles from roof to roof.

The railway ends at the Russian village of Andijan, at the base of the Tienshan Mountains. Only a few months before we came a great earthquake had destroyed the town and most of its people. I noticed that the brick posts—a foot square—of the fence of a cemetery had been turned on their bases in the same direction to about the same angle.

Here we left our car to wait indefinitely our return, and continued on horses. At Osh, Colonel Saitza, the Governor, arranged the details of the journey of several weeks to the Pamir, including the contract with a Kirghese for guide, men, and mounts.

Our route took us to Gulcha and up the valley of the Taldic-darya (darya means river) to the Taldic Pass. It was now the end of June, and the Kirghese were migrating to the rich pastures of the high Alai valley between the lofty parallel Alai and Trans-Alai ranges. The Alai valley is open through July, August, and September, and after that buried deep in snow. The Kirghese came from many parts of the lower valley of Ferghana, and the different family units seemed to vie with one another in display of wealth. The men rode in advance driving their herds of cattle, horses, and sheep. The family of each unit followed. The women were in gaily-colored Bokhara silks, head coverings and jackets resplendant with coins, and the forehead hidden under pendants of beaten silver. All the camels, connected in single file by ropes, followed the wife, who on horseback led the way hold-

ing the leading rope. The daughters rode free on superb mounts.

It was a magnificent procession of gorgeously-dressed women, graceful prancing horses caparisoned with silken bridles and richly-woven trappings, and precious carpets covering the burdens of a long string of solemnly moving camels. And everything, from the costumes, trappings, choice carpets, and connecting ropes of gaily-colored wools to the felts and frames of the dome-shaped *kibitkas* in the loads on the camels, had been made by these women.

We found Taldic Pass partly covered with deep snow, while on bare spots lay numerous skeletons of animals that had here found a final rest. A steep descent brought us into the beautiful Alai valley ten thousand feet above the sea. This is a wonderful trough between two great mountain ranges of Asia. Across it, beyond fifteen miles of grassy slopes, rises abruptly the lofty Trans-Alai, a snow-clad range with ice-domed peaks, rising twenty to twenty-four thousand feet above the sea. Streams fed by restricted glaciers of to-day are bringing down silts that are burying immense moraines of glaciers of at least three epochs of the glacial period. Great and smaller *cirques* form a larger part of the face of this gigantic wall. And on the backs of past and recent glaciers of these *cirques* had been brought immense moraines that descended far across the Alai valley. Here a Kirghese chief entertained us with the stirring *baiga* or *kok-buri,* in which about fifty men mounted on stallions fought for a prize to be given by me. With the chief I stood on a wall of earth eight feet straight above the bottom of a ditch about fifteen feet wide. By my side lay the carcass of a freshly killed goat. The man would be the victor who could drop the *skin* of the animal near me on the earth. We stood facing the deep ditch. Before I could think of danger those fifty daredevils, coming from behind, had passed without touching me, had plunged into

the ditch and were away over the plain. One had seized the goat. Now it was, who in the mad flight could hold and skin the carcass?

All around the temporary holder a struggling mass of riders swung their whips, drawing blood from horses and from neighboring riders, reaching over from both sides and from behind and over each other to grasp the half-skinned goat. Twice a horse and rider fell buried beneath the rushing, trampling *meleé*. Twice they had swung around a three-mile circle. The goat was gone. One man held high the skin to throw it at my feet, another caught it, but in the onward rush all plunged headlong into the ditch, and there they stalled and struggled—a mass so dense that horses' noses stood pointed to the sky, and I saw only the swaying bodies and stretching arms of men fighting for the hide. Then all were out again—a man sitting firmly on the skin—all wildly coursing over rocky plain, lashes cutting horses, horses fighting with teeth till, again closing the circle, a rider was able to throw the skin at my feet and claim the prize—a silken coat. The riders all had blood-stained hands and faces, and gashes from the skinning knife, but there had been no sign of anger. This all was a part of the game.

Then another goat was killed, and, untired, men and horses began anew. Then came a tearing three-mile race of little boys on stallions. The Kirghese children are put alone on horseback when barely three years old.

At Bor-daba, on the southern edge of the valley, we camped, and the next morning we engaged yaks—the patient, long-haired and humped oxen of Tibet—to carry firewood for use on the Pamir. That day a ride of about fifty miles led us up the Kizil-art and over Kizil-art Pass (13,721 feet), and across the head-waters of the Markan-su that feeds Lake Lob-nor, and over Kizil-kul Pass (13,081 feet) onto the Pamir, to end at the dark and lonely Lake Karakul.

It had been a hard ride over high passes and plains swept by winds and whirling columns of dust. I was not tired. I had borne the long trip better than the others, and felt quite superior to them; but on dismounting I found my legs so heavy in that altitude that I could barely move, while Norton and Raphael started off to climb a thousand feet, each anxious to get one of the giant sheep. Both succeeded, but unfortunately Raphael's turned out to be a doe. Although an excellent shot, with this exception he had given up killing except for food, and did not try again during the expedition.

The Pamir, aptly called the "Roof of the World," is a plateau standing 12,000 to 14,000 feet high at the point where the Himalaya and the Kwenlun ranges, after inclosing the Tibetan highlands, converge to meet the Tienshan Mountains. It is traversed, and surrounded, by mountains 18,000 to 26,000 feet high. Above 18,000 feet these heights are domes of ice, from which descend glaciers feeding rivers that flow to the undrained basins of eastern and western Asia and to the Indian Ocean.

The region is a barren desert. All the moisture brought from without is condensed to ice on the inclosing heights. Under the daily range of 80° F. the mountains crumble.

On the plains of the Karakul basin erratic blocks disintegrate to form heaps of gravel, and this into dust to be carried far away to find rest as loess in grasses of semiarid regions.

"Nowhere is there a more desolate land. It is a desert of unexpected forms, time-crumbled mountains and wind-worn cliffs, strange hollowed and pitted boulders, and sand-polished stones, efflorescent salt plains and drifting dunes, with here and there the remnants of an old bleached skeleton with sun-cracked horns." (R.W.P.)

According to Sven Hedin, the precipitation is less than one inch in a year. In July we found the stream channels

KARAKUL, THE SALT LAKE OF THE PAMIR

on the plain dry during the day. The water melted on the glaciers during the day arrives at the plain at night, and is gone before morning, for after sunset the streams freeze at their sources.

In the depression of the blue-gray plain of finely stratified clay lies Karakul Lake. It covers perhaps 180 square miles, its shore white with efflorescent salts, itself ever dark. Far into it jut high peninsulas bearing well-marked shore-lines at 60, 120, 200, and 300 feet, thus marking former levels of the lake corresponding probably to successive glacial epochs. From the eastern mountains imposing moraines of ancient glaciers stretch down across the plain. No one lives there. Ducks and waterfowl find food in a watergrass. We saw a troop of the great Marco Polo sheep—*Ovis poli*—but their summer haunts are near the ice-line at 18,000 feet. Here and there are found their horns, stretching to a width of three to five feet.

It was a wonderful experience to stand in the midst of utter desolation and look far out onto the giants of the earth—ice-capped crests and peaks—that on all sides guard approach to the "Roof of the World."

At night here, indeed, in eternal silence, amid dead Nature and crumbling giants, and under glowing heavens—all parts of a harmonious whole—one stood, an atom, lost in the awful vastness of time and space.

In connection with the Aryan problem, this desert suggests a grave rather than a cradle; but the high valleys on the edge of the Pamir are inhabited by peoples speaking Aryan languages. They seem to be the remnants of different stocks who, retreating before overwhelming hordes from the east, have found asylum in these mountain fastnesses.

On our return to the Alai valley we found many Kirghese units already settled with their large herds of camels, horses, sheep, goats, and cattle. The plain was dotted with their

dome-shaped *kibitkas* of felt over a trellis of light sticks, the walls inside, and the ground, covered with richly woven hangings and carpets. They were a hospitable people glad to offer *kumis* to the traveler, and to be photographed arrayed in gorgeous silks and ornaments of silver.

While our excursion to the Pamir yielded no archæological data, it gave important geological and physiographic results. We were able to show that there had been at least three great epochs of the glacial period, and one of lesser extent, with interglacial intervals. They were grandly recorded in large glacial troughs cut in the bottom curves of larger, older troughs, in younger and relatively fresher moraines, and in terraces.

I must add that the hard work of finding the critical points in the field, and credit for their interpretation, was due chiefly to Raphael's energy, while I was able to confirm the correctness of his observations and deductions. They were all the more important because they were the first found evidence of successive great phases of the glacial period in Asia.

These results obtained in the first half of July, 1903, were fully corroborated by Raphael when, on his private expedition in 1904 over the Pamir to Kashgar, he was able to make more extended observations. In August of 1903 Mr. Huntington records finding evidence of two, and possibly five, epochs of the glacial period in the Zerafshan valley.

At the same time that Raphael and I were subdividing the glacial period on the Pamir, Professor Davis was studying the same problem under more difficult conditions in the Tienshan range, and coming to the conclusion that there had been at least two epochs.

After reaching the railroad we made an excursion on horseback to see a city mound that had been cut through by the Syr-darya (Jaxartes), exposing a section about fifteen or twenty feet high. Near where Alexander the Great got his

FAMILIES OF A KIRGHESE PRINCE AND HIS SON

KIRGHESE MAKING FELT RUGS IN THE ALAI VALLEY

army across the Jaxartes we crossed on a ferry, while the horses swam. In calling on the chief of police for some information, he looked me over in suspicious surprise, then, seeing the name on my card, he opened a large folio and, suddenly becoming very cordial, showed me a circular order from the Governor-General to give help to the members of the Pumpelly expedition. The ruined city proved uninteresting.

When we recrossed the Caspian I knew that the reconnaissance had not only obtained remarkable results in geology and physiography, but that it had also shown that there existed sites to explore for traces of ancient civilizations. Their relation to the Aryan problem remained to be tested.

On our way by rail through the Caucasus to the Black Sea, we made a side excursion to study, in the mines, the extensive beds of manganese ores at Kutais. A Greek freight steamer carried us slowly to Constantinople, touching at points on the Anatolian coast. Everywhere in the villages large white houses, with red tiles on pyramidal roofs, among gardens and trees, rose one above the other on the steep declivity of the shore. I realized that what I looked on was Islam, but that the water we were ploughing so easily was the Pontus of the Argonauts, and that we had embarked at Colchis, the home of Medea. Behind these cliffs had flourished and fallen the civilizations of ancient Armenia, Capadocia, and the forgotten Empire of the Hittites, and the cultures of Greece, Rome, and Byzantium.

We stopped to coal at Herakleia, and Raphael and I followed a path up a gorge to see some ruins, and examined two caves in the limestone. Entering one of these by a small opening, and descending about fifty feet on steps cut in the rock, we came into a room inclosed by hewn walls, and with a well in the floor.

Another cavern was a room about 80x30 feet, the floor

covered deep with earth. Slabs of marble abounded, and we inferred that the room had been walled with these. There were also fragments of columns. At one point the earth had been removed, exposing a beautiful mosaic floor with delicate arabesque designs in which appeared the *thyrsus*.

On the Orient Express we made the acquaintance of two Georgians from Tiflis—Prince and Princess Begtabegoff—who were destined to add much to the pleasure of our next expedition.

I had only the last three months of 1903* to prepare for the expedition of 1904.

* The results of the Expedition of 1903 were published in one volume, *Explorations in Turkestan*, with an account of the "Basin of Eastern Persia and Sistan."—Carnegie Institution of Washington, 1905.

CHAPTER LII

TURKESTAN, EXPEDITION OF 1904

On the 16th of December, 1903, I sailed for England, on my way to Petrograd, where I hoped to get permission to excavate in Turkestan. Fortunately I had the companionship of my wife. Raphael and Langdon Warner were to meet us in Egypt. As Raphael took with him our firearms, which were forbidden in Turkey, our Ambassador in London, Mr. Choate, kindly got for me a *laissez passer* from the Turkish Ambassador. It was in Turkish, and in sending it to me Mr. Choate wrote: "After reading it I am not sure that it doesn't call for your instant execution." It was a pleasantry that I had reason to remember later.

We had a charming visit to my old friends Sir Frederick and Lady St. John on the Isle of Wight. I had not seen St. John since 1865, after our return to England through Siberia.

We met there an American lady—Miss Marsden—who had spent much time and effort in remote parts of northern Siberia, trying to better the condition of the numerous groups of lepers.

Berlin was an important stage in this expedition, for the great Voelkers Museum offered an opportunity to study the results of excavations in the whole sphere of prehistoric Mediterranean art and life, including the Danubian region. Troy was represented by the collections made by Schliemann and Dörpfeld. I was not an archæologist, but extensive reading and inspection of collections in London, Paris, and Berlin were teaching me the essentials.

Baron and Baroness Ferdinand von Richthofen were very good to us during our stay here, and my wife found delight in the picture galleries.

It was my intention to begin work by excavating the big mound at Anau near Askabad. I had found it abounding in fragments of broken painted pottery of an evidently very old type, and that these at the top were different from those beneath, and of finer make. I saw that my archæologist must be an expert in prehistoric ceramics. The excellence of the arrangement of the Schliemann Collection so impressed me that I asked the director to let whomever had arranged it go over it with me. He kindly did so and I spent much time under the guidance of Dr. Hubert Schmidt, with the result that I felt that I must have him as archæologist. It took two or three days to get permission from the director and authority from the government—I promising to give in return to the Voelkers Museum half of whatever the Russian government granted to me—and then to persuade Dr. Schmidt. It was arranged that we would meet at Tiflis on March 15th.

Among the interesting things Richthofen showed us were the great Institute of Oceanic Geography established under his initiative and direction, and Urania—a museum filled with working models of all sorts of mechanical and electric machines, etc., which any one was free to set in motion by touching a button.

In St. Petersburg on this visit I received no help from our Embassy, largely because there was a new Secretary. In personal interviews at the Foreign Office Count Lamsdorf and Mr. Hertwig were courteous, but insistent that no foreigner was allowed to make excavations. At last I went direct to Count Bobrinsky of the Archæological Commission, who only discouraged me. After several hopeless interviews he said: "You had better give it up. Even if we should give permission we should keep everything you find." My answer

was instant: "I don't want to keep a thing. I want only to dig, study, and describe."

The idea that any one should be willing to spend large sums without having the objects found seemed to put the matter in a new light to the Count, and he said he would see what might be done. The next day he wrote that my request was granted. When I called again on him he gave me the authorization issued by the Minister of the Court. Then producing a letter from Count Lamsdorf, he said: "You made a mistake in applying to the Foreign Office and to your Ambassador. These diplomats don't help. They always object and save themselves trouble. In it Count Lamsdorf writes: 'I find that the Minister of War has arranged for Mr. Pumpelly to travel in Turkestan. Nevertheless he must not make excavations.'" Count Bobrinsky added: "A clause in this letter is intended to give the impression that the refusal of your application for permission to dig is due to instructions from the Emperor, but I know that there have been powerful influences opposing you." One of the objectors was Countess ——, whose husband has established a great museum of early Russian antiquities in Moscow. There were also the archæologists who were interested in the civilizations of the past twenty centuries, who feared that in looking for the earlier cultures we should destroy those remains. I explained that I would respect any points these gentlemen might indicate, and, moreover, would contribute money for them to make their excavations before we should touch such points. I would also be glad to have their representatives with me at my expense.

In parting Count Bobrinsky said:

"Remember, when you want a favor, don't go near the diplomats, but come direct to headquarters."

At this time the war between Russia and Japan was coming on. The Ambassadors of both powers were recalled, but no

interest in the matter appeared on the surface. At the offices of the General Staff, where I often went about maps, they made light of it: "The Japanese will run," they said, "as soon as we show our hand. They are only bluffing."

"I know the Japanese," I answered. "They will fight, and well too, though you may beat them."

The next day there was indignation at the General Staff. One of the Generals said: "The Japanese have done a foul thing. War had not been declared when a Japanese warship came to Port Arthur to arrange for the removal of the Japanese. The Admiral came ashore with a servant, and was entertained by our officers. That night Japanese war vessels sank a number of our men-of-war, and it turned out that the man our officers were having to dinner was really the servant—meanwhile the Admiral was outside, noting the positions of our ships. It was a dastardly contravention of the etiquette of war."

I must note here that the officers of the General Staff were very kind in providing me with good topographical maps of the great region covered by our expeditions, as well as much personal information. This they would not have done for a European.

The awakening of the people to a sense of the imminence of war was sudden and dramatic. All political factions loyally united. For days the *Nevsky Prospect* was thronged with crowds going to cheer the Czar. Foremost among these in loyalty were now the students, always the most revolutionary part of the people. Facing the throng-filled square at a window of the Winter Palace, the Emperor stood bowing. I could just distinguish him behind the great plate of glass.

Directly opposite the windows of our apartment, there was always a sight to delight the anti-vivisectionist, especially the proprietor of *Life*. In a shrine by the sidewalk was an

PILGRIMS ON THE KREMLIN

icon (a small picture of the Virgin) which was continually being kissed by passersby, mothers always pressing their babies' lips on the same spot that had been touched by countless other lips. In the hotel the whole story below ours was occupied by the son of the Khan of Khiva. The picturesque members of his great retinue filled the corridors. The Prince—a descendant of Mohammet—moved with the bearing of an Oriental monarch.

We spent a day or two at Moscow. Here, amid all the semi-Oriental splendor, two things of human interest impressed us. One was the simplicity of the house and home life in which Peter the Great was reared, as shown in the small and perfectly preserved house in which he passed his childhood. The other was a group of three peasant pilgrims who had come on foot from a remote part of the Empire to worship at the shrines on the Kremlin. In their picturesque and travel-stained clothes they stood before the church they had just left, two old men and a youth, good types of Russian peasants deeply interested in the wonders they had seen. They were mystics seeking the secrets of the spiritual life.

We stopped over at Kertch, in the Crimea, to see a real *kurgan*—a tomb of a King of Pontus, of perhaps the fifth century B.C. It was a stone pyramid containing a long, narrow, and lofty room, under a steeply pointed relieving arch, the whole hidden in a high mound of earth. There were several of these *kurgan* tombs, that had yielded priceless treasures of Greek art in gold work, while on the walls of one there still exists the oldest known specimens of Greek mural painting.

Thence we sailed to Sebastopol, along a shore famous from antiquity for its beauty, and studded with Russian villas. A pleasant drive took us to Balaklava to find the scene of the "Charge of the Light Brigade." No one had heard of

a battle at Balaklava. Later we found that we should have asked for the Chernaya River, near which we had actually passed.

At Chersonese we were shown the Museum of Antiquities from Greek tombs of the fifth century B.C. Our guide, the director, Mr. Kosciusko-Valinetgovitch, was a descendant of the sister of the Kosciusko who fought in our Revolutionary War.

Raphael met us at the dock in Constantinople. He had got everything through the customs without the *laissez passer*. Unfortunately, having that paper in my pocket, I handed it over to the inspector, who, I think, was on the point of passing my things. There was a consultation. They scrutinized me. That paper resulted in my being rather severely ordered to open everything. When we came to a big trunk the inspectors pointed to a grey powder near it on the bench. I denied that it came from my things. "Open it," they said, and to my horror I found the same powder over the contents of the tray. Then I saw one of two forgotten cans of carbide for an acetylene lamp had burst open. Further unpacking brought to light the cardboard case of the lamp, on which was a graphic picture of rays shooting out in all directions from a central object. The inspectors started back. It was a clear case of an infernal machine. They looked daggers at me, and ordered slaves to take away the cans and case. However, after a long search, they passed the rest of the baggage. I thought that was all, but the sequel was worse. The next day Mr. Jay, acting in the absence of our Ambassador, sent a paper from the palace granting to my wife, myself, Langdon Warner, and Raphael admission to the terrace from which we could see the Salaam-lik—the Sultan going to the Mosque. We had to enter through an iron gate. My wife advanced on Warner's arm. When they gave their names to the officer on duty he examined the paper and checked off. Raphael,

happening to be next, they let him in and closed the gate, leaving me out. Protesting did no good. They insisted that the paper called for only three persons. Two soldiers took me away, and stood, one on each side of me, behind a row of slaves well out of sight of the street down which would come the Sultan. After some time the soldiers received an order, and took me by a roundabout way to the stables, and kept me there under guard. After a while the dragoman of our Embassy came up flourishing a paper, and I was taken back to stand again behind the slaves near the terrace. I saw the officers at the gate examine the paper, and send it away. Then I saw it returned and I was admitted. It was raining. All the ladies and their escorts were under umbrellas, excepting only my party. Theirs had been taken away by the guard. We were not allowed to leave to go to the hotel, as we heartily wished to. Raphael, Warner, and I were placed in a row some distance back from the parapet, with soldiers to carefully watch our every motion. Every one else was left to move about freely. I happened to put my hands into my pockets. They were instantly ordered out. Thus we stood while the Sultan drove in front of us to the Mosque, and while he made his long prayer and the rain did its work to the skin, leaving the cold to penetrate to the marrow. As a sight the Sultan was a miserable failure. But the trooping of the resplendant regiments of different branches of the cavalry was really wonderful, and almost modified the aspect of my mood.

All this was doubtless due to the mention of firearms in the *laissez passer*, the infernal machine, the Italian sound of my name, and the anarchical length of my beard.

A day or two before sailing Hildegard Brooks, daughter of my associate, Major Brooks, arrived and announced that she was going with us as a volunteer to be useful in any capacity. She had hoped to find us in Egypt. It was a

brave undertaking for one so young to take the chances of missing us and having to follow into Central Asia.

To avoid a delay of a week we had to sail the length of the Black Sea on an oil steamer. All I remember of the trip was great numbers of dolphins that raced alongside and performed fascinating pranks around the bow.

The way by train from Batum to Tiflis lay through the longitudinal valley that separates the mighty Caucasus range from the Armenian highlands. On both sides rose snow and ice-bound cliffs and peaks, and down the long vista the glow of sunset tints vanished slowly to linger on the greatest heights.

This valley has from remotest time been one of the three greatest highways between the East and the West. Out of it, from behind the veil of prehistory, came motives for immortal tragedies. Here Jason found Medea and the golden fleece, and on a cliff of Caucasus Prometheus was bound.

The waves of the earliest westward migrations necessarily rolled around the southern shore of the Caspian Sea. From here a route over the highlands of Armenia led to Syria and the Mediterranean. Another all-land route lay along the west shore and through the narrow passage between the sea and the end of the Caucasus, and thence over the steppes of southern Russia. Between these stretched our valley, ending on the Black Sea. And from here there was no outlet except by water, for on both sides the mountains come down in sheer cliffs into the sea.

During the ages peoples, driven from their lands and fleeing before migrating hordes, were caught in this *cul-de-sac* and in high valleys found a lasting refuge.

Many are the languages spoken by these remnants of forgotten stocks. More than sixty are recorded, some of them of still undiscovered affinities. In later ages commerce in precious products of the far East passed through this valley

and over the Black Sea in ships, to enrich Greek cities of the Pontus and in Greece itself.

At Tiflis we had an interesting experience. Prince and Princess Begtabegoff had for us several dinners and a ball. The guests to meet us were from the Georgian princely families—and all in their national dress. Like our charming hostess, several of the ladies were women of exceptional beauty. During dinner, according to the national custom, everybody around the long table was toasted; after each toast, there was sung a native song improvised for the person pledged, in which all joined in the refrain. Then came the national dances. I remember a very interesting one—based on the ancient custom of marriage by capture—in which the lover chases the fleeing girl who glides swiftly over the floor. It all—singing, costumes, dances—belonged in the middle ages.

The head of the Begtobegoff princes made my wife promise that on our return in the summer we would visit at his castle in the mountains—a promise we were unfortunately unable to fulfil.

Among the Georgian women it is considered immodest not to conceal their hair under a head-dress. One gentleman told me he had never seen his mother's head uncovered.

Our Georgian friends came loaded with flowers to see us off on the train. The station was crowded with officers leaving for Manchuria, and friends to say good-by.

From Baku a night voyage brought us to Krasnovodsk. Here, after bathing in the Caspian, we ensconced ourselves in the car ordered for us by Prince Hilkoff.

At Askabad we met Huntington and Yantschivetski. Our party now consisted of my wife and myself, Miss Hildegard Brooks, Dr. Hubert Schmidt, Langdon Warner, Huntington, Yantschivetski, and Raphael.

Having decided to excavate the mounds at Anau a few miles east of Askabad, I sent thither all of the party except

my wife and Miss Brooks, who stopped with me to buy necessaries. In the Russian cities of Turkestan the place of hotels is taken by lodging houses called *Nummer*. The one that received us was kept by a capable woman of middle age who had turned to this after having been the mistress of an officer. One day, as I stood with her in the doorway, the chief of police and a handsome young woman passed us, mounted on superb horses. Our landlady returned their bows, and after watching them with an expression that seemed full of memories said: "*Elle est sa nouvelle maitresse.*"

One reason for tarrying at this place was the wish to make up some packages of cotton seed I had brought from America. On my previous trip the Governor-General had expressed a wish to have some varieties of selected American seed for experimental planting. The way I got them in Washington is worth telling. The Secretary of Agriculture was absent, and his son, who was in charge, treated roughly my request for samples of seeds and publications of the department to be sent to the Governor-General of Turkestan: "No, we haven't anything for those fellows. We can't bother with selecting seeds. Let them buy the reports at the second-hand bookstores."

Then I tried with the scientific gentlemen of the bureaus of the department.

"Only say what you want, and you shall have it. You want three sets of seeds. Each shall be of twelve varieties carefully selected. And we will make up three sets of our publications, and will forward all as you shall direct, and will take pleasure in doing this well, and anything else in our power, for we have had favors from Russia."

The great table-land of Persia is bordered east of the Caspian by a broad zone of parallel mountain ranges. Of these the northernmost—the *Kopet-dagh*—forms an escarpment that rises 4,000 to 7,000 feet above the vast plains

which, with an altitude of a few hundred feet, extend to the Arctic Ocean. As far as into Siberia the region, including the Caspian and Aral seas, is a land-locked desert basin with no drainage to the ocean. Practically the only water that comes into this basin is that precipitated on the high mountains which inclose it on the south and east, and from the river Volga that feeds the Caspian. See map (p. 699).

From the high-lying glaciers of the Tienshan, Hindu Kush, and Pamir flow two great rivers to feed the Aral Sea. Elsewhere streams large and small reach the plains only to spread out and evaporate. At present, throughout this vast basin, the inflow of water and the evaporation are at a point of stable equilibrium. Should there come a sufficiently long sustained inflow from increased precipitation on the mountain sources, other things remaining equal, the basin would fill and form an inland sea to drain to the ocean and to the Mediterranean. On the other hand, should the equilibrium be changed in the direction of dryness, sufficiently prolonged, the streams would shrink and evaporate on the desert, while the Caspian and Aral would dry up.

Along the edge of the Persian table-land the escarpment is cut by deep gorges, through which flow streams supplied by the precipitation on the bordering mountains. On leaving the canyons these torrents spread out upon the plain, lose their velocity, and, depositing their silts, disappear through absorption and evaporation. The lands covered by these silts, really the dry deltas of the streams, are the oases of Turkestan. With some exceptions they cover only a few square miles, although the remains of village mounds farther out on the desert are proofs of former greater extent.

Everywhere these oases are hemmed in by a wall of encroaching dunes of sand blown from the desert.

Through the ages the fate of the oases lies in the balance

between the dual powers of good and evil—water and "flying sand."

The silts and coarser débris that are brought by the streams from the mountains are, as already said, at once deposited on the plain. The oases and the intervening sand dunes form a narrow zone of ever-accumulating material along the base of the mountains. The load that is taken from the highlands is being laid upon this belt of lowland, as is also the sand blown from the desert. Under the relief the mountains rise and under the load the narrow oasis-dune belt sinks. The effect of removal of weight from the mountains is shown, for more than a thousand miles from the Caspian to the Pamir, by block uplifts along the escarpments. And the recurring relief of stress results in earthquakes along this line.

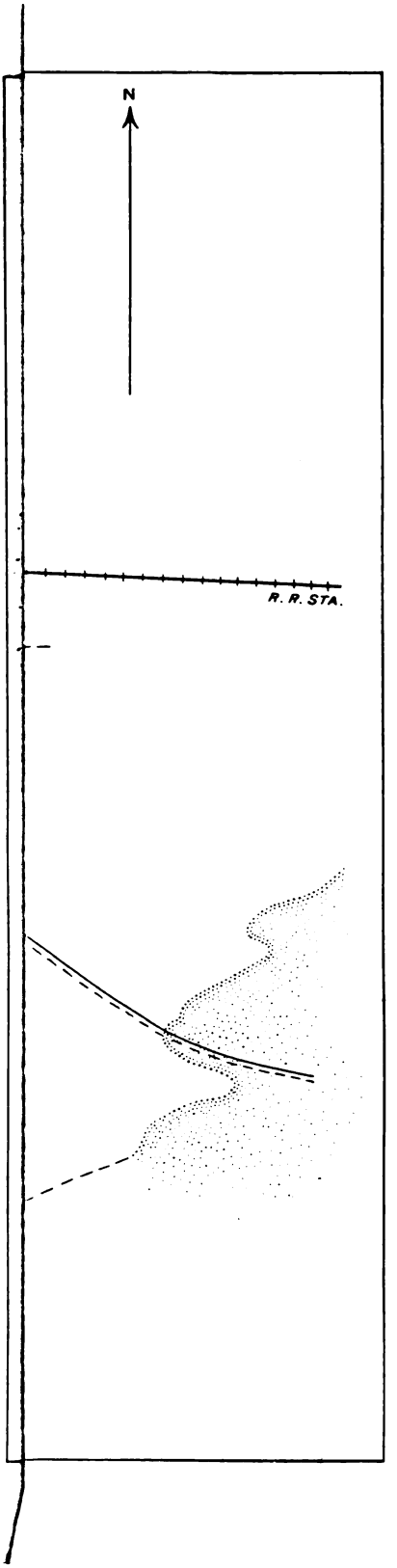
The effect of this relief is a line of dislocation along the escarpment facing the plains. Here the rising mountain mass is seen to have bent steeply upward the beds of alluvium. This is well defined at the oasis of Anau. (See section on p. 727.)

In time successive dislocations give rise to ridges lying parallel to the escarpment of the hinterland. Thus there would seem to be a tendency to advance the mountainous region outward at the expense of the plains.

Streams from the elevated hinterland are clearly able to maintain their course across the rising ridges while they receive as tributaries the local drainage of the longitudinal valleys.

This is well shown on page 729. Here two streams descending from the Alai Mountains, maintaining their channels across a rising axis of dislocation, spread out to form new oases.

This is a well-known fact in the case of some rivers maintaining their courses across rising mountain ranges by deepening their gorges as fast as the mountains rise, but the instance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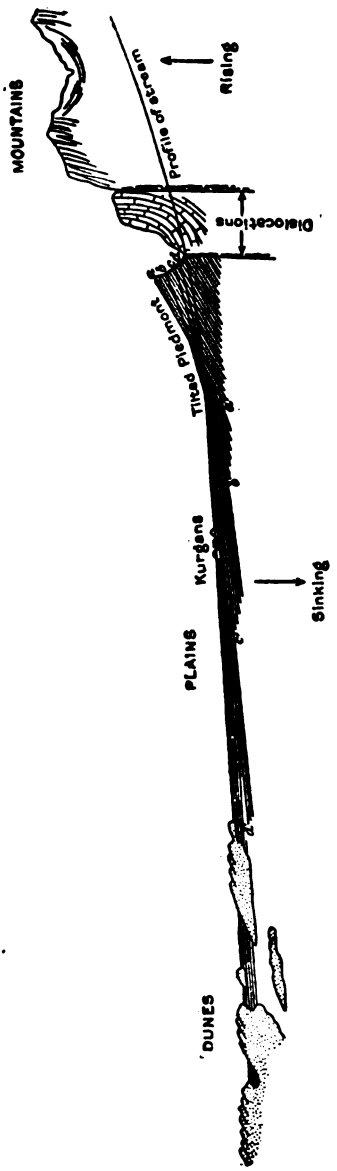


PARTLY IDEALIZED SECTION OF THE ANAU DELTA OASIS ON AN UPTILTING PIEDMONT

The lines a-a', b-b', c-c', d-d' represent the former levels of successively tilted terraces in the gorge through the tilted piedmont (a-a' the oldest and d-d' the youngest), with their contemporaneous horizons of alluvium buried in the delta plains

shown on map, page 729, is remarkable in that in each of the streams not only the main channel but several distributaries kept their courses across the rising ridges. This topographic alteration in the oasis belt becomes of great interest because the later phases of it are, as I have said, interwoven with remains of the early civilizations in the interlapping of the oasis culture strata with alluvium of the deformed delta plains.

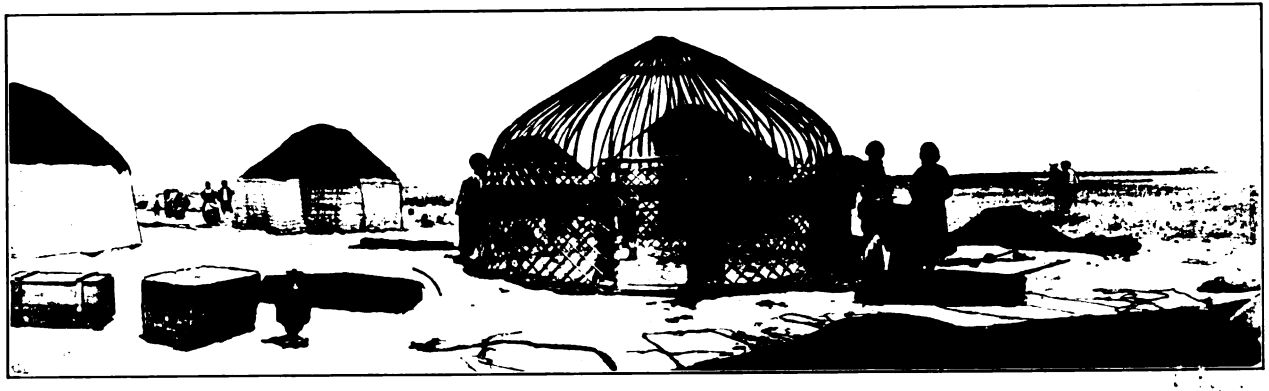
On the other hand, proof of the sinking of the loaded belt is found in an artesian well at Askabad. This well was sunk over 2,000 feet through alluvial deposits without finding their limit in depth, this while the great plain to the north consists of horizontally stratified rocks.

In their structure the oases consist of thinly stratified fine silts, except where the streams, in issuing from the gorges, quickly deposit such coarse material as gravel and cobble.

About the middle of March we left our car on a side track within sight of the mounds we were to excavate, and proceeded to make an encampment. This consisted of *Turkoman kibitkas*—dome-shaped dwellings about eighteen feet in diameter and twelve feet high made of felt stretched over a collapsible framework of light sticks. Besides Turkoman servants, we had from a German Colony a blacksmith, and his wife for cook. Each one of the party had a fine Turkoman stallion. These horses had to be kept well in hand, for they were given to fighting savagely with each other. Once on a steep hillside my wife on her mount got into a *meleé* of kicking and biting horses.

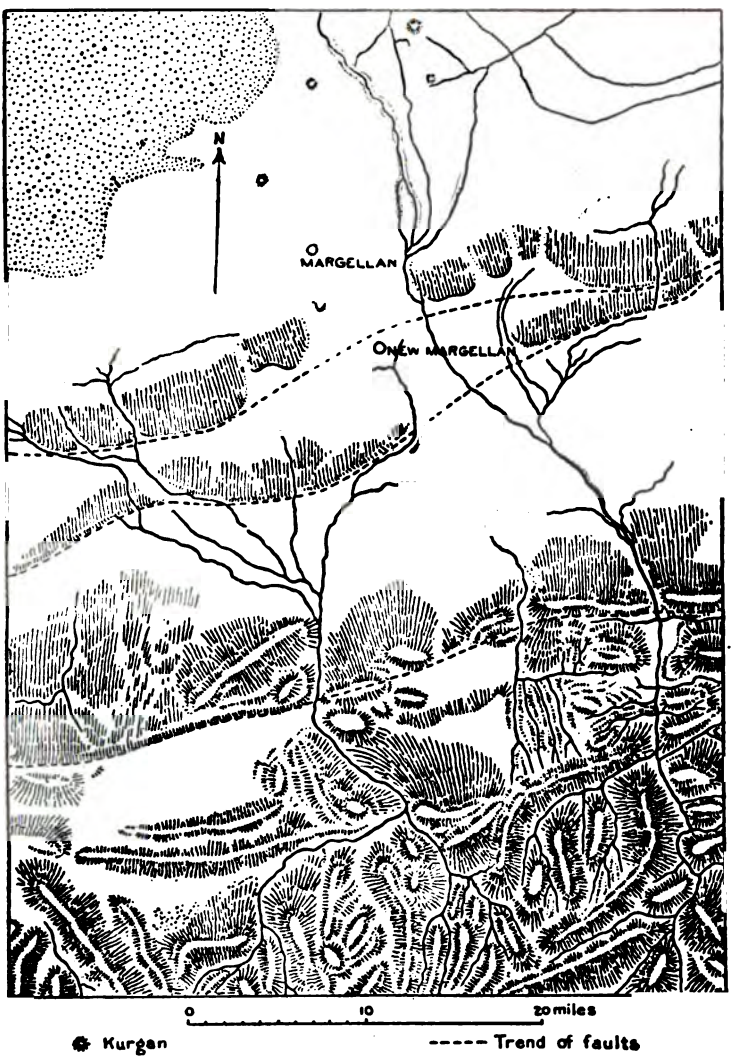
Since the publication of the results of the excavations of 1904 important changes in the chronology of Egypt and Babylonia, and discussion of the results of DeMorgan's excavations at Susa, have made it necessary for me to reduce the dates of the second and third civilizations of Anau. I have, therefore, thought it well to redescribe briefly in an

THE SOUTH KURGAN AT ANAU



ERECTING A KIBITKA

appendix the results in the light of the new chronology for Anau II and III.



UPTILTED PIEDMONTS OF MARGELLAN

The reader interested in the origins of civilization will find there evidence that the fundamentals of European civilization—organized village life, agriculture, domestication of animals, weaving, etc.—were originated on the oases of Central Asia long before the time of Babylon and brought to Europe in the later Stone Age.

DESERT ASIA

Only mounds now, only rarer traces,
  Tell where cities slowly sank and died away,
Tell where hearts and hopes of passing races
  Came to nought in melting mirage, time's decay—

Only mounds on far horizons fading
  Over tossing sands where tall, grey camels graze,
Clear at morning, blurred at even, shading
  Out of desert shadows into glowing haze.

Tired nomads, there at even singing,
  Sound the echoes of a long dead world's despair;
Music of an ancient people ringing
  Down the ages fills the desert everywhere.

Over barren hills forever haunted
  Comes the chanting of the sad Hyrcanian shore;
Sorrowing winds of Asia waft unwanted
  O'er a wasting sea still tossed by storms of yore.

He who hears it sees remote recesses,
  Vague beginnings of an olden world's arrears,
Ruins of Oblivion's blurred abysses
  Looming in the everlasting mist of silent years.

There are vistas dim where clouds dissever
  Over far forgotten lands of lavish gleam,
Generations that are gone forever,
  Kingdoms crumbling in a dim primeval dream—

Leaving only deserts gray and lonely,
  Sites of unremembered cities gloomed and grand,
Tenanted by winds and shadows only,
  Desolating winds and dunes of idle sand.

—Raphael Welles Pumpelly.

CHAPTER LIII

LIFE AT ANAU, MERV, AND SAMARCAND

THE work at Anau was full of an interest that never flagged. It was my first experience in excavating. For Dr. Schmidt, who was profoundly versed in everything relating to prehistoric archæology of the Mediterranean sphere, there was nothing, in the South Kurgan, that offered analogies for comparison; and, even after Dr. Duerst had shown that the oldest culture—Anau I—belonged in the time of the beginning of domestication of animals, he refused to admit that Anau 1 was older than the third millennium B.C.

When I discussed this point with Professor Hoernes, one of the first authorities on prehistory, he saw no objection to my dating—as I then did—the beginning of Anau I in the end of the ninth millennium. Professor Hoernes considered not only the obscure archæological element, but also the more significant evidence of domestication of animals, and the geological and geographical facts—the time required for the distribution of these animals through Europe in the Stone Age.

In the study of prehistory, intimately related as it is to mutations through time and space, physiography and biology are essential factors.

The region about Anau was attractive, and our superb Turkoman stallions often carried us over and beyond innumerable irrigation ditches, over dunes to the desert, or into the mountains. Out of the ruins of the city of Anau rises a mosque, a great structure shattered by many earthquakes. Of this the *façade* is still nearly perfect, resplendent in its facing of fifteenth century tiles.

The work here was brought to an end by a cause beyond our control. One hot day in May I sat watching the sinking of a pit on a slightly raised and hard-dried part of the oasis. Suddenly I saw all around me little particles of earth rise and roll over. They had stopped the entrance to holes. Out from each hole there issued in quick succession thirty or more insects about an eighth of an inch long. Each of these at once shook off from its rear end a fluffy gray attachment, and hopped away toward the southeast. The astonishing thing was that this began while I was looking, that the holes opened simultaneously all about me, and that every insect instantly hopped off in exactly the same direction.

It was the birth of a locust raid that was to consume every green thing to the roots, and plunge the people into the horrors of famine.

The whole surface of the oasis became at once covered with an endless insect army, always twenty or more per square foot, and all marching southeastward. The soft grains were just appearing on the heavy stand of wheat or barley, and by the next day every ear on every stalk was a black mass of insects. By the time this army had exhausted the juice in the grains and marched on, there arrived, marching in a different direction another invasion of locusts grown somewhat larger, which devoted itself strictly to the young leaves on the stalks, and then hopped away on its former course. And so on, new armies coming from new quarters, grown larger and adapted to tougher parts of the crops. Soon they had grown to perhaps an inch in length. As they halted at the edge of an irrigation ditch, they piled up till a ridge was formed so high that it kept caving off into the water, and the swiftly flowing stream, covered day and night more than an inch deep with the black mass, formed a bridge for the ever-oncoming army to cross on.

The ditches emptied onto the fields, where the water, partly

TOWER OF DEATH AT BOKHARA

absorbed and partly evaporated, left the surface hidden under a thick and rotting mass that poisoned the air far and near.

In marching nothing caused the locusts to vary in the slightest the direction of their course. Telegraph poles were climbed to be descended on the other side. When they came to our shafts, they descended the sixty or ninety-foot depth and, failing to climb the opposite wall, fell back and piled up on the bottom. These shafts were sunk for my son to study the character of the strata and to collect pottery. In one he stood knee-deep for half an hour in locusts and wriggling snakes, and in a continual shower of the insects, many of them falling between his shirt and skin.

At last, when they accumulated in our excavation pits faster than the men could shovel them out during the day, we had to stop work and flee from the growing stench that rendered the air unbearable. Up to this time the insects had not reached the flying stage. Over a large part of Russian Turkestan the Turkomans were in a pitiable condition. Only those on our oasis were saved from misery by the money obtained for labor at our excavations.

There was one episode that was both interesting and pathetic. Far away in Persia there was a certain kind of bird supposed to be fond of locusts, and, near there, a spring favored by these birds.

Our Turkomans sent a man to bring some water from the spring, as there was a tradition that the birds would follow and exterminate the pest. The birds arrived before the messenger returned. They swept over the country in immense clouds, darkening the sky, and, settling for a few minutes, they cleared the ground and moved on. But in spite of their appetite, they made little impression on the inexhaustible billions of insects.

Our landlady at Askabad had told us that while we were

at Anau the chief of police had ordered her to send off all her guests, keeping one room for a traveler who would arrive in a cab of a certain number, and had then filled all the rooms but one with secret-service men. Then there arrived the expected guest—an English Major—who as a tourist called on the Governor, who entertained him. Baron Tcherkesoff told me that, as expected, the Englishman visited Bokhara. But, without paying the customary visit to the Agency at New Bokhara, he had quietly got on the branch line to the old city, and on arriving there had been met by three Indians whom the police had suspected. While the Englishman went to engage a carriage, the police spirited the Indians away and confined them.

I was told later by the Governor of Samarcand that Major Smyth was cordially entertained by him, and at Tashkent by the Governor-General.

An officer versed in Turkish, Persian, and Indian dialects, was detailed to act as guide, so that throughout his journeyings east of the Caspian, while being very hospitably cared for and allowed to talk with the natives in their languages, he was incessantly under observation.

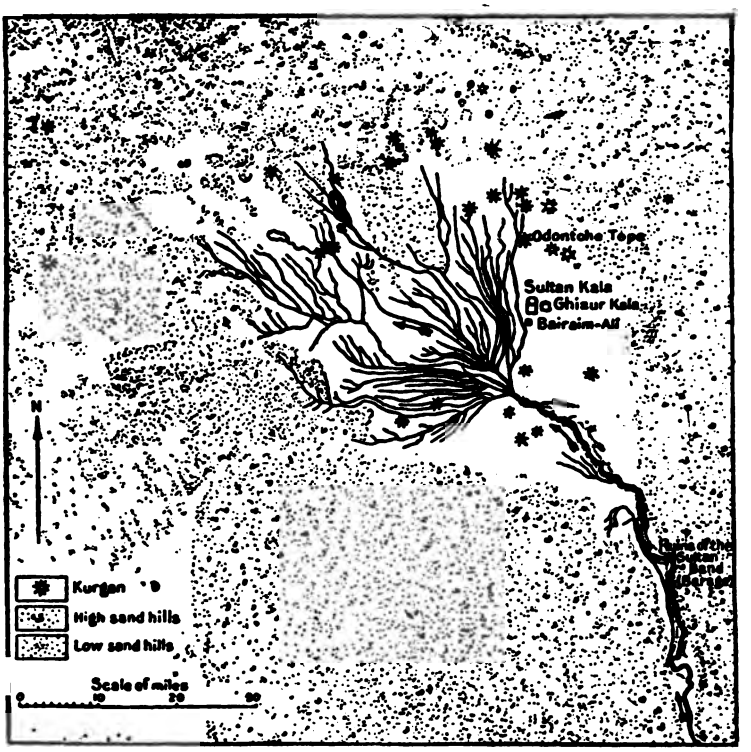
They said the Englishman's quest seemed to be to learn whether the Turkomans, Kirghese, and Afghans would be tempted to rise against Russia during the Russo-Japanese War.

On the 21st of May, 1904, we reached Bairam-Ali. We were here in the Imperial domain on the oasis of Merv. The new director, Mr. Yeremief, and his charming wife—a niece of Tschaikowski—put a furnished house at our disposal, and did much to make our stay agreeable, as did also the assistant director, Herr von Brandt.

The oasis of Merv, on which the river Murgab ends its course, was once a cultivated tract of great extent. It is now almost wholly a desert, from whose surface rise the ruins

of crumbling cities; and the time-wasted mounds of older settlements dot the plain far out into the desert.

A statement in Persian literature that Merv was the "Mother of Cities" invited exploration, but how was one to



MAP OF THE MURGAB DELTA OASIS OF MERV

choose among so many sites? Bairam-Ali, only a few centuries old, was built from the bricks and tiles of Sultan Sanjar, of the ninth and tenth centuries, which in turn had despoiled the extensive ruins of Ghiaur Kala. *Ghiaur* meant

infidel, and that the city was probably destroyed before the Mohammedan invasion. So, on account of its extent, we began to dig there, instead of perhaps more wisely attacking the neighboring Iskander Kala (City of Alexander the Great).

We had only made a beginning at excavation when some of us, and some of our native workmen, began to suffer from an enteric trouble that killed at least one of the natives and ended our efforts. However, neither our pits nor the deeper shafts seemed to indicate a greater age for the city than the later centuries before Christ.

Ghiaur Kala consisted of a greater and a smaller part separated by a high wall. Both were surrounded by time-wasted walls, and just within the smaller city there rose a massive tower. From this, looking over the northern quadrants, as far as with field glasses we could see, there were high and low mounds of ancient settlements dotted on the now desert plain. I have little doubt that still older mounds lay wholly buried beneath the alluvial deposits and encroaching dunes. Indeed, beneath this formerly vast oasis, and under that of Seistan in Persia, may lie records of the background and beginnings of the cultures of Anau, Susiana, Chaldea. With Raphael I rode twenty miles or more northward, to visit a mound with a high tower. Its visible part was not older than the Sassanide period, but what impressed me was the intensity of the heat on the barren desert. Lying on the ground in the shade of a wall, I gasped for breath, and found relief only in the saddle and in moving. We could then believe the statement of the natives that it would not be a good year for crops unless in May one could, in one day, cook to hardness three eggs one after another buried in the sand. The academician, v. Middendorf, found by experiment that this required a temperature of 185° F.

Notwithstanding the sickness and disappointment, the charming hospitality of the Yeremief, the beauty of the

Imperial Garden, and the sweet singing of the nightingales those weeks in the Imperial domain remain in memory a delightful episode of the expedition.

The oasis of Merv stands far out in the desert. After leaving it we entered the region of dunes, which along the railroad were covered with constructions of brush to stay the flying sands. In the morning we reached the Oxus, a broad river whose shifting channels had left one long bridge high and dry, and necessitated the building of another. Charjui, at the eastern end of the bridge, is a garden spot on a large riverbank oasis of the Oxus, and is famous for the excellence of its many varieties of melons. The choicest kinds are brought to market with each one inclosed in close-fitting basketwork.

At the Russian town of New Bokhara we stopped to pay our respects to Baron Tscherkesoff, the Russian agent, for Bokhara is an independent khanate under the Suzerainty of Russia. Here our car was switched onto the track leading to the city of Bokhara.

In 1903 Baron Tcherkesoff had arranged for us a visit to Bokhara, detailing as guides two gorgeously dressed native officials. The Ameer was absent, but we were received with much ceremony, both civil and military.

We made an excursion of several days on horseback to the ruins of Paikent, till the early centuries of our era a great center of wealth and of commerce between China and the West and South. The recession of the lower ends of the Zerafshan River brought the doom of the city, and it is almost wholly buried beneath invading dunes.

As guests of the Ameer, we were accompanied by three gentlemen of Bokhara. I see them still, men of fine bearing, agreeable, and dressed in robes of richest silk confined at the waist by broad belts of silver inlaid with turquoise.

Our visit of 1904 was quietly made. We had heard much

of the tower where, from its lofty height, criminals were hurled to death. Incased in richly colored tiles, and rising high above the city, it is a blazon of former glory. I believe Russia has stopped its ghastly use, but the lot of prisoners is perhaps worse. We saw near there a foul, cave-like hole, where they stretched out hands into which we put tobacco and money to buy tea.

The great bazaar is the most thoroughly Oriental one in existence. Its narrow streets are shaded from the sun by roofs of latticework. Every trade has its special quarter.

Bokhara is distinguished by an art peculiar to itself. Its silks, surpassingly beautiful in color and texture, and characteristicly native in design, are purely Bokharan, so are its carpets, its jewelry, and its embroideries. We bought many things and ever after grieved that we did not buy more. On our second day we made the acquaintance of the agent of the Ameer of Afghanistan, with whom we passed agreeable hours in drinking tea, smoking cigarettes, and bargaining for rubies and lapis lazuli.

The time we used up in lunching at a little restaurant kept by a Russian seemed a wasted opportunity, and we hastened to a shop where some evil genius kept us from buying priceless old Persian pottery and things from ancient tombs—shapes and colors and designs of ornament that still haunt my memory. But Dr. Schmidt bought a silver bowl of the Roman period and of a kind of which only two others are known.

Then we went to the house of the Afghan agent, who had invited us to tea, my wife being entertained in the harem, where the ladies talked in signs and smiles. As evening drew near, my wife and I went to the pool—the glory of Bokhara—a basin several hundred feet long, all the sides formed by stone steps descending to the water. A broad promenade surrounds it, and grand old trees overhang the steps. On one

THE POOL AT BOKHARA

side this wide walk separates the pool from mosques, on the other side from restaurants and barber shops. On the flat roof of a tea house we two Europeans sat on cushions and sipped our tea, much to the amusement of the polite native guests.

The pool was evidently the general meeting place of the men of the city, rich and poor. We looked down on a lively scene of loitering people, some in gorgeous silks, others in rags. Many sat on the steps, cooling their feet in the water, while water-carriers filled their vessels, and we realized that thence had come the water for our tea.

In several barber shops were men having the long *ritchka* worm extracted from their arms. The operation lasts several days, and every barber keeps on exhibition bundles of the dried worms eight or ten inches long. All the water of the oases is infested with larvæ of this pest, and every one has had the *ritchka,* or is having or going to have it.

Arrived at Samarcand, my wife and I made the visit required by etiquette to General Medinski, the Governor of the province. We were shown into the garden where the General and his secretary—Mlle. Collins—were seated at a long table under a great mimosa tree. Our reception was so cordial that there was quickly established one of those unforgetable friendships that sometimes fall to the lot of the traveler.

Our host had served in all the campaigns in Turkestan, and was a fine type of soldier. Mlle. Collins was an educated woman of Irish birth.

When we moved to leave, they insisted that we should stop with them during our visit to Samarcand. The General led us to a superb Bokhara tent. They sent to have the rest of the party come to pass the evening, and had the necessary things brought from our private car.

Another tent had been put up for Miss Brooks.

These tents were large and square with pyramidal roofs, all of thick cotton without, and lined within with richly decorated silk. They stood under wide-spreading trees near a little lake in the park.

At about eight o'clock we had a light supper, and learned that dinner would be later. Our host spoke only Russian and Polish, but Mlle. Collins, with whom we talked in English or French, translated rapidly as we spoke.

That night, and for many days and nights, there was abundant material for conversation—about the country, its resources, the natives, the methods of administration, and stories of the campaigns—so that interest never flagged.

Dinner came at midnight or sometimes an hour or two later. At this meal there were usually present officers who had spent the evening at cards, and the General read the war news from a sheaf of telegrams. Our hosts did not appear in the morning till the noon meal.

Ever since leaving America I had been troubled by the burden of having promised to ask a certain question when I should be in Russia. The question was a very simple one, but the propriety of asking it seemed more and more doubtful. However, if I was ever to keep my promise, this seemed to be the only opportunity.

Before leaving America, J. D. Hague read to my wife and me the proofs of *Clarence King Memoirs* which he was editing. In the part contributed by Hague was an account of King's friend "Don" Horatio Cutter of San Francisco. Cutter was both philosopher and idealist—King called him "Socrates and Don Quixote." He had never heard of Yacub Khan, the bloodthirsty tyrant of Kashgar, but he was intensely indignant when he read in the London "Times" that the Government of China, after conquering Kashgar and killing Yacub Khan, had condemned Yacub's sons to be sent as soon as they should be ten years old as

slaves to the soldiers on the Amur. He did not rest until he had succeeded in getting Congress and some foreign offices to make a successful appeal at Peking.

Hague said to me:

"Now I would like to know what really became of those boys. You're going out there, and you might find out in Russia." I promised to try, but when I reached Petrograd it occurred to me that, being bent on asking favors from the Government, it might be well not to show interest in Central Asian politics. However, when we were guests of the Governor of Samarcand, and were sitting in the garden with his secretary, Mlle. Collins, I asked her if she could find out from the Governor what had become of the sons of Yacub Khan. Then came the startling answer:

"Yes, Beg Kuli Beg. *I was to marry him.* He lives in exile in Khokand."

Think of it! After holding my tongue half-way across the Eur-Asian Continent, the first person I ask tells me she just missed being Mrs. Beg Kuli Beg! Think, too, of the sequence of events that ended in the possibility of our making a charming acquaintance that helped toward the success of the expedition. Yacub Khan massacres the Chinese in Turkestan. A Chinese General, in a remarkable campaign, massacres the Mohammedans, kills Yacub Khan; and Yacub's children are decreed to be slaves to the soldiers. This little item in a newspaper catches the eye of a gentleman in California whose intense idealism results in the saving of Yacub's heir, and to our profit in meeting Mlle. Collins in the house of her rescuer. Her story, too, was interesting. Her father took her to Geneva to be educated. When she was fourteen her father died, leaving her penniless and without relatives. She became infant governess in the family of a Russian officer, who was sent as Governor to Khokand, where Yacub's son was held by Russia. The exile, who was very wealthy from

the revenues of his estates in Kashgar and Khokand, and was a friend of the Russian family, became infatuated with the very young governess, and by means of rich presents brought the Governor and his wife to induce the girl to marry him. She was too young to know what it meant to be tied to a Mohammedan. One day she said to him: "I don't love you. What would happen if some day I should fall in love with some one else?" He answered: "If he should be a Russian," he shrugged his shoulders; "but if a Mohammedan, so!" and he drew his hand across his throat. Then she rebelled, and was persecuted until she was spirited away by General Medinski and his wife when the former was appointed Governor of Samarcand.

Samarcand, the ancient Marakanda, had been, from remote antiquity, through Bactrian, Greek, and mediæval time, a great city—great in extent, in population, and in wealth. At present it is a Russian city with broad avenues shaded by majestic poplars descended from ancestors of the Lombardy tree. The great trunks of these are smooth and green from the ground up. The trees, like the gardens, owe their luxuriant growth to constant irrigation from the Zerafshan River.

The native city near the Russian quarter consists now of dusty lanes and adobe houses. Of past glory nothing remains but the wonderful mosques and tombs of the time of Tamerlane, in the fifteenth century. But these are worth the long journey from the far West; and they too are doomed by their position on the earthquake zone that extends from the Tienshan Mountains to the Caspian Sea.

Three mosques inclose three sides of the market place or *registan*. On their great façades—the portals are eighty or more feet high. In producing the great façades of enameled tiles Persian artists lavished all the resources of their art to produce effects of transcendent beauty in color and

RUINS OF SAMARCAND FROM AFROSIAB

A MOSQUE OF MEDIÆVAL SAMARCAND

design. There is also the now ruined tomb of Tamerlane's favorite wife. Fragments of its tiles show, in beauty of designs in colors and gold, the highest attainment in that art. Aside from these, there is a connected series of tombs of saints, I think, still perfect. In the decorations of all these there is no repetition. As a rule the background and designs were painted on the tile, and then burned in. But in one instance the design was inserted in the tile, somewhat as in Florentine mosaic. The tile was made with a channel to receive the decoration, which was painted and burned separately.

Adjoining the native city, there is a large nearly level elevation consisting of culture strata. It is supposed to be the site of the city of Alexander the Great, and on its highest parts, according to the legend, stood his palace, where in an orgy he killed his friend Clitus.

The drunken orgies that played so important a part in Alexander's career in Asia were probably partly due to the fact that the water was, as it is to-day, the carrier of serious enteric diseases, and the Greeks were forced to drink the fiery wines of Asia, which were far stronger than those of the Mediterranean vineyards.

One may wonder how history might have been affected if, like the Russians and the natives of to-day, the Greeks had had tea and the *samovar*.

The whole surface of this elevation—called Afrosiab—is devoid of structural remains. The only evidence that it once bore a city is a great depression that doubtless marks the site of a pool of the Bokhara type. It now serves as an amphitheater, where on its arena is played the favorite game of the *baiga*.

At Samarcand our party broke up. Langdon Warner started on his romantic trip to Khiva. Huntington had been detailed to explore the oases of Merv. Raphael and Homer

Kidder were preparing for their independent expedition to the Zerafshan glacier and over the Pamir to Kashgar.

At our farewell dinner, General Medinski made me appear in the uniform of a Russian Major-General.

At our car we bade good-by to our hosts, in the firm but unrealized expectation of seeing them again the next year.

CHAPTER LIV

1905 TO 1913

EVERY preparation was made for a new expedition to continue in 1905 the work so happily begun. The Carnegie Institution had made a generous grant of money; the personnel was ready. The Rockefeller Institute had recalled for me Dr. Brinckerhoff from Manila where he had been studying tropical diseases, for we were going to face an epidemic of cholera in Turkestan. A professional photographer was waiting with several thousand plates. At the last moment one of the trustees had the expedition indefinitely postponed because of the revolution in Russia. Prince Hilkoff and the Governor-General of Turkestan wrote that there was no danger, but the expedition was blocked, at least until, on arriving in Europe, I should be able to get more definite information about conditions in Russia.

In December, 1904, my wife and I sailed to Europe, hoping that I might be able to have the expedition follow.

I might as well record here an amusing incident anent the habits of the malarial mosquito. As Turkestan is a terribly malarial region in summer, I sought advice from Dr. J. S. Billings. He said that there was danger only at night and in the dark. He doubted whether the Anopheles mosquito would bite even in candlelight. Soon after this as I sat at a dinner next to Mrs. Russell Sullivan under a brilliant electric light a mosquito lighted on the lady's hand and, in my desire for knowledge, I begged her to let him get a good hold. She kindly suffered while I caught the insect in a chloroform tube, for I was then studying the habits

of that pest. It was a malarial mosquito, and to Mrs. Sullivan's martyrdom is due the important credit of refuting the idea that the Anopheles fears the light. I knew that no danger attached to the experiment because, although the malarial mosquito is omnipresent, and is the only variety in whose insides the malarial organism can pass through an essential stage of its development, that development requires, for ten or fourteen days, a continuous temperature higher than ever obtains, uninterruptedly, on the higher ground in the interior of New England.

The discussion of the results of the work of 1904 was expected of me as well as the editing of the reports of my collaborators. As I was not an archæologist I had to read extensively in the literature of prehistory to obtain sufficient knowledge at least to avoid serious mistakes. Notebook in hand I had studied the collections in the prehistoric museums of Russia, Germany, France, Switzerland, Italy, and the Caucasus; and got together an excellent library for reading and reference. It was a new education. I pursued it with concentrated application and with intense interest in both its archæological and physiographic aspects. For five years it was my life by day and, I might say, my dream by night.

The best works on the geology and physical geography of Turkestan were in Russian. With the aid of a dictionary and grammar I managed, in the winter of 1902 and 1903, to read them and make desired extracts.

The hardest part of the editing was in translating the technical parts of the different reports written in German, French, and Italian, especially those relating to human and animal anatomy, where dictionaries and medical friends were often not able to help me out.

Fortunately while, as regards archæology, Turkestan was untrodden ground, I had for comparison of such cultures as I should unearth with those of the far and near Orient

IN THE MARKET AT SAMARCAND

BARGAINING FOR RUBIES AND LAPIS LAZULI WITH THE AGENTS OF AMEER OF AFGHANISTAN

From a photograph by R. W. Pumpelly

the results of the great work of DeMorgan at Susa in exposing the sequence of civilizations from the Stone Age up and their relations to those of early Chaldea as shown by the work of deSarzec and other French excavators, and the researches of DeMorgan and Reisner in the field of earliest Egypt, as well as those of Schliemann and Dörpfeld in Troy, and of Evans in Crete. And these were sources of Western civilizations.

The two years from 1904 and 1905 were passed partly in Italy and partly in Switzerland in conference with Professor Duerst and partly in Berlin with Dr. Schmidt. The winter of 1906-07 was spent in Egypt. The years 1906 and 1907 were devoted partly in Europe to translating the reports of my European collaborators, in editing the two volumes, and in writing my discussion of the results of the expedition of 1904.

With my wife and Raphael I spent every winter in Europe from 1904 to 1907, chiefly to consult with my collaborators and in visiting the prehistoric collections. We landed each time at Naples in the autumn and sailed for America from Liverpool in June. Part of each winter we lived in Capri, where there was always a small and agreeable literary and artist circle. Jerome had settled there to write a history of the decline of the Roman Empire, tracing the decadence to neurasthenia. He had a delightful villa. To get to it you go in a long street, under the old palace of Queen Joan. A door in the wall, in this dark tunnel, opens into an ancient garden. There is no trace of a gardener's attempt to interfere with the heritage of age. The stains of time on walls and pergolas and on the bark of big Aleppo pines, and the thick trunks of wide-spreading vines loaded with roses, all surround you with a wealth of fragrance and of antiquity in arrested decay.

The villa forms the wall above which it rises.

Charles Caryl Coleman lived in another old palace, a good background for the fine old painter. Here he caught and gave the languid spirit of the bay of Naples.

Here, too, Theodore Williams was translating Virgil, and Andrews interpreting Faust.

Before sailing for Europe in December, 1905, I was able to write, from the results of my excavations, my address as retiring President of the Geological Society of America for the meeting at Ottawa. The attendance was very large, not only of members but also of citizens, and I was made to feel that the address was liked.

In the autumn of 1906 we went to Egypt, stopping over at Athens. Our object in visiting Egypt was chiefly to measure the rate of upward growth of the village mounds around temples since the decree of Theodosius II abolished the old Egyptian religion. This quest took us to the principal ruins. Of Egypt I shall only say that I still dream it, the color over its golden sands, its temples and palms, its patient donkeys and impatient camels. And, through it all, the ever-present sense of looking down a vista of sixty centuries on empires rising and falling while the Nile flows on forever.

I had a long talk with Signor Maspero and met Messrs. Naville, Reisner, and Corelli, and the latter gave me a fine collection of paleolithic flints from the desert. We had also a chance to see the tomb-finds of my friend Mr. Theodore M. Davis.

We went only as far as the first cataract and stopped longest at Luxor, wandering by day in Thebes and the Tombs of the Kings, and among ruins by night, for then the gods gather in Karnak's halls and the jackal bays at the moon.

Since we arrived in Egypt before the tourists I had the good fortune to be able to buy some treasures of the far past, one an exquisite little head in gold of a cow, the other

a very delicately carved bas-relief of either the fifth or the eighteenth dynasty, representing a papyrus marsh and, in a boat, a man seated and drinking, while near him stood a bull calf and in the bow a naked woman holding a net.

I had rented at Capri, for the winter from January, 1907, the little Villa Chiara below the via Tragare, and there I fell ill with broncho-pneumonia. However, dear old Dr. Cerio—though he was a year younger than I—brought me safely out. This was done not only by his care as a physician but by the long friendly visits of a man of many scientific interests.

About this time my wife had a remarkable experience. As we sat down to breakfast, she said: "I have had a sad night. I dreamed that I saw (my brother) Otis and (my sister) Kate in tears; and Otis was saying 'how can we tell Eliza' " (my wife). Within an hour there came a cablegram from my son-in-law, Harry Smyth, in Boston, saying that Mr. Horace Shepard (my wife's favorite brother) was desperately ill and could not recover. An hour later came another cable announcing the death of Mr. Horace Shepherd. Mr. Shepard had really died before the sending of the first one.

Mr. Otis Shepard had died several years earlier.

In 1907 I was in Vienna to visit the museums. While there I went to see once more, after fifty years, the Hotel *Zur Kaiserin Elizabeth*—the scene of my mouflon's pranks. It was now a restaurant and changed beyond recognition. The whole ground floor was one great room, where in my time had been dining room, court, and kitchen. Calling the manager I asked when this change had been made. "I have been here twenty years," he said. "It was done before I came. I have heard that great changes were made in converting the hotel into a restaurant."

I looked for the stairway. Instead of the stately flight that I remembered so well there was now, but in a different place,

a smaller spiral staircase. The old one had been removed in the alterations.

I wondered how many of the people who had heard me tell the mouflon story had seen the present conditions and noted the discrepancy between them and my description.

While I was in Vienna I was asked to give a lecture on our work in Turkestan. I was to be there only one more day and I should not have time to write the paper. They said: "Don't write it, just tell it in German." Now I had never dared to speak off-hand, even in the National Academy of Sciences or elsewhere; and I had not spoken German for a half-century. I was on the point of refusing altogether when I remembered that a distinguished German, at a Lowell Institute lecture, had said "as the vind sighs thruff the buffs of the trees."

So at sixty-nine, without any preparation, I made in German my first extempore address before about one hundred and twenty scientific men. I knew there would be mistakes, especially in the wrong prefixes of verbs, but remembering "thruffs" and "buffs" I plunged boldly in and, without hesitating, spoke for an hour and a quarter. Frequent smiles that spread through the audience marked my errors, but I saw no one nod or sleep.

By invitation I attended a jubilee meeting of the Imperial Academy of Sciences. I don't remember what it commemorated, but for half an hour the secretary read a document chiefly relating the condescending interest shown by the Emperor and the various archdukes at many times in the Academy. The members were all in the gala dress of the Academy, with many gold decorations. A Count, whose name I forget, came to me to send a friendly message to Mark Twain, who had been beloved in Vienna.

I also saw a good deal of the geologist Suess and of Penck.

The dream of forty years of my life had come to an end

with the appearance of the volumes treating of *The Civilizations of Anau, Their Origins, Growth, and Influence of Environment,* and of their relations to Asiatic and European origins.

I awoke to find myself transported from the period when under great stress the essentials of our own civilization were founded on the oasis of Central Asia, essentials which, in forced migrations, were carried to Europe, first by infiltration and later by conquest; and I found myself in a new *milieu* in which man, having wrested from Nature her magic wand, was making of her the slave of his needs and of his appetites.

I awoke to find history repeating. Subject to economic pressure that forced the Celtic tribes into Europe, and that later caused the Teutons to drive the Celts to the South and to the Atlantic, the descendants of both, and of other races, are infiltrating into our commonwealth at an increasingly overwhelming rate that threatens to submerge its founders. Will this infiltration be constructive or destructive? Will it, also, be followed by conquest?

Brooks Adams tells us* that in the Roman Empire, notwithstanding ever wider spreading conquests of fertile regions, under the stress of increasing exhaustion of the soil and of decreasing efficiency of labor, nourishment of the growing population required successive importations of people more resistant than their predecessors—races able to work longer hours with greater energy.

Nearly half a century had passed before I revisited Germany in the first decade of this century. In her relation to the industrial and political life of the world at large those fifty years were one of the most critical periods of history. The change was startling. In the cities the population was

* *La loi de la Civilization et de la Decadence,* the French edition of *The Law of Civilization and Decay.*

contained within the mediæval walls. Grass grew in streets of the smaller ones. Any sanitary arrangements that of necessity existed were doubtless inherited unchanged from antiquity, and only too evident to the senses. When I returned in the first decade of the present century the grass was gone, sanitation was scientifically perfect, and vast suburbs extended beyond the walls. Everywhere one saw evidences of tense activity.

In the fifties the industries were still chiefly carried on by individual handicraftsmen, skilled and thorough each in his trade and teacher of his apprentices.

Now industry had become merged into great manufacturing units, with labor specialized in the details of work and socially organized in trade unions.

I had gone to Hamburg in a German sailing ship typical of her few shipping lines. Now the charts of the oceans were covered with a network of German steamer lines reaching out in menacing competition for the world's commerce.

Then the beauty of its scenery and the romance of its legendary history had made of Germany a delight to the wanderer. Now the formerly favorite routes were too often vulgarized. I took my wife to have her enjoy the romance of the Rhine valley as I had revelled in it—when, tramping and dreaming, I had led a charmed life in a languid atmosphere of ruined castles and their legends. Alas! railway trains rushed along both shores, the air was full of smoke, and the grand old castles had been hideously "restored" by millionaires. Even Nature was no longer genial.

As to the people I met with, I saw little of the Prussians, but everywhere else in Hanover and at Freiberg and on extended tramps I had found all classes kindly and helpful. I do not remember a single disagreeable episode during my four years of residence. Now a change had showed itself, sometimes through unpleasant brusqueness, at times through

THREE GENERATIONS OF RAPHAEL PUMPELLYS, 1917
From a photograph by Elise Pumpelly Cabot

downright rudeness, especially among officials and minor officials—changes doubtless often due to increased pressure of business and to socialism.

Among the untitled classes at least, in the matter of morals, feminine *complaisance* before marriage was more leniently treated than among Anglo-Saxons, and did not necessarily lead to complete degradation or even ostracism, nor did it act as an insuperable obstacle to marriage and the making of a good wife. It was unmoral rather than immoral. Now, I am told, statistics of illegitimacy show, in this respect, a marked increase.

In the fifties political discontent had found expression in whispers. Now that discontent found loud expression in organized socialism.

In my time God and Luther still had a place in the minds of the people, but it was a sombre religion. It found symbolic expression, at wayside shrines, in the agony of the Christ on the cross, and in dismal hymns. I remember a typical one portraying life as a vale of tears—"*Thraenen, Thraenen, immer Thraenen?*" ("Tears, tears, only tears?") was the refrain. Now the God of Germany was Thor with the hammer and Fortuna was her Goddess.

Then, materialism was confined to scientists. Now, it was universal. Theology had become apology and historical discussion.

In my time the men who had made Germany preëminent in pure science were teaching unhampered by politics. Now, there had been made a great change in the methods and aims of education. Many of the greater minds had been brought to the enlarged University of Berlin where, as among the lower schools of Germany, tactfully and through the bestowing of titles, education was gradually both commercialized and diverted to further the aim of Empire expansion that has culminated in the Great War.

In December, 1908, my wife and I took passage for Naples, intending to motor through Sicily. From the agent of the express company I learned that heavy rains had made Sicilian roads unsafe. Therefore we decided to go on to Genoa and the Riviera. After three days there happened the great earthquake that destroyed Reggio and Messina. The news of the bad condition of roads in Sicily undoubtedly saved us from the fate that befell these cities, for it had been our intention to leave Naples the next morning and take two or three days to get to the straits of Messina. Our names were among those reported as lost. European friends cabled to America for information.

From Genoa we went on to Cannes to have a delightful visit and excursions with our Dublin neighbors, the Francis M. Jencks.

January and February found us enjoying the life at Bordighera and the excursions along the Riviera and inland to picturesque towns that crown hilltops and in places extending down and around the sides.

After a trip to Naples we passed March and April in Rome, where we had a few friends and acquaintances.

May found us in Venice where we had intended to spend a month, but had hardly arrived when a cablegram from Raphael gave us barely time to arrive in New York in time for his part in a double marriage. I bought transportation for ourselves, the chauffeur, and car, by the *Prinzessin Cecilie,* relying on the assurance of the agent that it would arrive in New York one or two days before the date of the wedding. In London we found the assurance was wrong and the tickets not redeemable. By changing to a fast Cunarder we reached New York with a day to spare.

As we left Grace Church after the ceremony we saw Theodore Davis, who came on the *Prinzessin Cecilie,* driving from the boat. The refusal to redeem the German tickets is

compensated by the fact that I am even infinitesimally interested in our collective ownership of the whole steamer.

I still regret the loss of the expected visit in Venice, for since Raphael could marry only one of the charming Ripley sisters he might have waited. Of course it would have been different if he could have carried off both prizes.

Before his marriage Raphael had made geological exploratory work for the U. S. Geological Survey along the coast of Alaska, and had made, on his own account, an expedition into the interior of Labrador. In 1909 he began as mining engineer in New York, and devoted efforts chiefly to studying the financial side of mining corporations by analyzing their statements over a series of years. In doing this he had got a valuable business education. After a year of this, in 1910, he and his classmate, Ralph W. Page, concluded that the rational thing to do would be to go onto the land and live a life of independence. Being innocent as regards everything connected with farming, they went to Washington and sought advice from Mr. Knapp of the Agricultural Department—apparently the only constructive branch of our Government. They were told that as things stood they should plant cotton, and that the best place would be in a hitherto unappreciated part of North Carolina; and that if they would get their options the department would send an expert to pass on the quality of the selections. They took options on a large amount of stump land where the pine had been cut twenty years before. The expert approved, and they selected 4,000 acres for themselves and sold the rest at an advance. The next year Raphael bought the share of his partner, who preferred to act as promoter.

Now—1917—after six years of construction and development, including two of learning the fundamentals, he has, exclusive of the uncleared land, a plantation of about 800

acres well balanced between livestock, dairy, pasture, fodder, and money crops, including corn, cotton, tobacco, etc. He calls it Samarcand after the old city on the Zerafshan River. Now for the first time he has a superintendent to relieve him of much of the work.

In May, 1911, occurred the first break in our mature circle through the death of our youngest daughter Pauline. Handicapped by an imperfect heart which kept her from school, the brave girl educated herself largely by reading, and got more than the average of true pleasure out of life. She had the happiness of eight years of married life and of being able to enjoy the early childhood of two charming children.

About this time I began to write these *Reminiscences*, partly for my children, but chiefly in order to have something on hand that would occupy my mind for several years.

After two years at home we crossed the Atlantic—my wife and I, our oldest grandchild, Charlotte Smyth, and my niece, Redina Kempson. We landed in November at Algiers to see something of northern Africa. I had brought a large Peerless car, and, with this, we exhausted the excursions around Algiers. There was a favorite one to an inn near the mountains, where big and little wild monkeys swarmed on roof and arbors and trees when travelers stopped to eat. We passed December on the way to Biskra and Tunis. It was a wonderful experience zig-zagging from the coast onto the highlands into view of the snowy Greater Atlas Mountains, now rolling along the smooth military roads on the plains, now winding through deep gorges where frightened monkeys scurried up cliffs and among the tree tops.

Biskra, the once charming oasis, had already been much spoiled by Hitchens' *Garden of Allah*. The real garden is indeed most interesting, but its superb trees and winding walks are not born of the desert. It is the beautiful creation of a French nobleman. But beyond, among the dunes

RUINS OF TIMGAD, NORTHERN AFRICA. A "FOREST OF COLUMNS"
From a photograph by Herbert Kiessling

TWO CORINTHIAN COLUMNS IN TIMGAD
From a photograph by Herbert Kiessling

with the rocky Atlas peaks on one side and on the other the vast Sahara, one is lost in the "Golden Silence" of the desert.

From Biskra our route took us through the ancient territory of Carthage to the ruins of Timgad. This region was a granary of Rome. Its importance and wealth is shown by the extent and beauty of its remains. It is now a forest of tall Corinthian columns protected through the centuries from robbery of its marbles by distance from the sea. The only modern buildings are a humble inn, a few Arab huts and those pertaining to the Government excavations and museum. In this last are preserved many mosaics of large size and exceptional beauty, especially in extreme delicacy of arabesque tracery. Of some of these Rena Kempson and Charlotte made drawings.

Although I am not writing a descriptive itinerary, I must speak of the Khabyles whose rugged country we traversed. Their villages of stone houses everywhere crown the tops of hills. In passing through one of these we were besieged by women offering their silver ornaments for sale. In entering a house I found the passage absolutely dark. Feeling my way my hand touched something warm and hairy. It was probably the head of a donkey in a side manger. The passage descended over time-worn stone steps and I found myself standing on level ground, still in such darkness that at least a minute passed before I became aware that I was at the side of an old man sitting near the embers of a fire; and with difficulty I saw what I thought was a woman lying, perhaps dying, on a stone bed against the wall. Not a word was spoken and I climbed out. Our Arab guide, Abdal Kader ("Joseph" for short), said all the dwellings were alike. No windows, no light. A girl standing at the door of one begged me not to enter, as a woman within was just being confined. After this episode I am not surprised that the Parisians are

now worried by the problem of who will clean the Khabyles, whom they have brought over to clean Paris?

Tunis is interesting through the interiors of its Arab houses with walls of choice tiles, and its nearness to the site of ancient Carthage. What pleased me most were the dingy shops in the bazaar, where one sees the native craftsmen working with primitive tools.

The car was swung by a powerful crane onto the steamer that was to take us to Naples. However, leaving the car to finish the voyage, we got off at Palermo, saw Monreale and went on through the still horrible Messina, to see Taormina buried in flowering almonds, and the majesty of Aetna beyond.

Our present journey was undertaken for the benefit of the two younger members. The result was that we made much more extended excursions and saw things more thoroughly than usual. After Naples we tarried long in Rome. Orvieto always had attracted us elders. A curious thing had happened here two years before this visit. Under the houses there were deep pits, like great cisterns, cut in the volcanic tufa on which the city rests. These pits and possibly the houses date probably from Etruscan times. They (the pits) had been forgotten until one of the popes, coming to live in Orvieto, ordered the inhabitants to dispose of sewage and filth elsewhere than in the streets. The pits then became cesspools and receptacles of rubbish, including broken pottery. In time some of them became full of solids. A tourist interested in ceramics saw some potshards being carted away and recognized rare majolica, and found a nearly whole plate. He started a mining boom among the householders, who gradually emptied these cesspools. As the accumulation had slowly grown with the centuries it was chronologically stratified, which gave especial value to the decorated fragments.

Collectors came from far countries and some pieces sold for hundreds of dollars.

I think it was in the same year that, in returning to Orvieto from an excursion, there happened an incident that threw a sidelight on the emotional side of the Italian peasant character. We were going along a narrow lane between some houses and going slowly, because the lane was barely three feet wider than the car. Suddenly a pig sprang through a hole in the wall and was crushed under a wheel. It was young and pure white and wore a blue ribbon around its neck. I got out just as three or four young men, on their knees, were examining the dead pet. They were in tears and repeating: *"Che dira la nonna, che dira la nonna?"* ("What will granny say?") They had not taken any notice of me, but soon one looked up and explained that it was the pet of his grandmother and that she would grieve at its death. It was quite common to see an old woman knitting with a young pig by her side. There was no trace of resentment towards me. Expressing our sorrow and my wish to at least pay the value of the pig, I asked how much that should be. One of the men said as it was a rather unusual pig it was probably worth fifteen francs. I had difficulty in diverting the grandson's attention to hand him the money. He thanked me and we parted good friends.

When politely addressed the Italians are quickly responsive. In the country towns they disliked automobiles, especially when carrying foreigners. When approaching a frowning group, for information, I lifted my hat at one and used the polite formula: *"Mi dica Signor ove e la Via Roma?"* ("Please tell me, sir, where is the Via Roma?") Frowns changed to smiles, hats were raised, and pains were taken to give careful directions.

Traveling leisurely, with stops at Siena and Florence, we tarried several days at unspoiled Ravenna. Here there were so few things to see that one could daily revisit and admire the old mosaics as well as take long drives in the country.

Then, too, Countess Pasolini in Rome had sent word to have their house in Ravenna opened for us every day for tea, and we had the pleasant sensation of having all to ourselves an old palace to roam in and an interesting library to browse in.

We were looking forward to having several weeks in Venice. But soon after arriving cables announcing the desperate illness of my wife's sister started us on a race in our car across the Bremmer Pass through Switzerland and France to London. Here we received word that Miss Shepard had died soon after we left Venice.

CHAPTER LV

THE DESERT

Blessed are the realms of Silence for in them is the nearness of God.

EARLY in March, 1915, with my children, I was on my way to Arizona. In the shadow of loss of wife and mother, we sought the healing influence of the desert.

For my children this journey was a pilgrimage to the scenes of my early adventures. We left the train at Tucson to prepare for the desert.

When I had last touched the ground at Tucson in 1860 there was only a cluster of mud huts, and a population which though not virtuous was happy, for it was far from vigilance committees, sheriffs, ropes, and wristlets. The owner of the one eating place greeted the hungry, one hand holding a revolver, the other outstretched and expectant.

Now, after half a century, Tucson was a flourishing city with fine streets, luxurious hotels and plate-glass-windowed department stores. I was a dazed Rip van Winkle. Was it only last night that I had slept on an earthen floor to wake up at the sound of shots and find myself among a lot of players who were dodging the bullets of two gentlemen, each casting aspersions on the other's moral character, and on the virtue of the other's mother?

This vision was still before me when I registered at the hotel. A reporter who had seen me enter my name hailed me as the pioneer of Arizona. From that moment I found myself to be the sole depository of history of Arizona before the Civil War—the legendary, heroic period. Among the

interesting men we met was Captain Burgess, a fine specimen of the old-time ranger and scout type, who wore his long hair in a knot on the back of his head. He had scouted with Kit Carson and Buffalo Bill, and enjoyed the occasional removal of one of the many bullets that enriched his body.

Before starting on our proposed desert trip we made an excursion of several days to the Santa Rita mines—where I had passed tragic months.

It was early March, with delightfully warm days and cool nights, and an air so clear that distant mountains were deceptively near at hand. A gravelly arid plain spread out for many miles in all directions, its monotony relieved only by clumps of sagebrush and here and there an *ocotillo* tree—always a picturesque group of tall stems diverging from a common root—and straight ahead the great *massif* of the Santa Rita peaks. It was a region for travel in the saddle and with pack mules, not for motor cars. With me were my three children, Raphael and his wife Amelie, Margarita, and Elise, who, although mothers, will appear herein collectively as "the girls." As it was to be a rough camping expedition, we carried only blankets and food, water and gasoline. Each had a roll of blankets stored on the engine hood. The food was bacon, cheese, bread, marmalade, canned beans, tea, and sugar. And there was a frying pan, wooden plates to be burned, and cups. There may have been also a knife and teaspoons, but we may have eaten with fingers.

Instead of tents I took twelve yards of extra wide and heavy canvas to pull over all of us in case of rain, for we were to sleep on the ground.

In the afternoon, as we came near the influence of the mountain, the country became uneven, dry watercourses appeared, the surface bore grasses of the semiarid region and cattle betokened the presence of ranches. We camped near the site of Fort Buchanan.

Scarcely a trace remains of the fort nor of its successor, Camp Crittenden. Looking at the site I remembered the mingled feelings with which I last left it, and our easy conscience in stealing the Colonel's pointer in revenge, and how well the dog justified the theft.

A long drive along the Sonoita, and then a long ascent among diabolically weird rock forms, brought us at about 4,500 feet into the zone of live-oaks and *mesquite acacias*. Here, too, charming small cacti nestled among the bare rocks, and the yucca, the amole—good substitute for soap—the Spanish bayonet and century plant. Those yuccas! On lonely night rides along this same route my imagination had seen in their dark bodies and tall stems possible lance-bearing Apaches.

We were now on the Santa Rita property. It was beyond recognition. In my time live-oak and *mesquite* trees gave the rolling country the appearance of a vast orchard of old apple trees, and the surface was covered with the semiarid grasses and small cacti. Now all was bare. The trees had been cut off; cloudbursts had stripped the surface.

In a solitary adobe hut lived a Mexican with a picturesque family. He tried to show the old hacienda. There were ruins of houses, much later than my time; but my furnace was standing as part of the wall of one of these, and the girls took as mementos pieces of the slag that lay near.

In spite of the general desolation the grander features of the scenery remained. On the north the great mountain stood unchanged, its structural lines all leading up to where at nearly 10,000 feet rose the ice-crowned peak. On the south, above a steep ascent, were the long cliffs that Grosvenor loved to sketch, and far in the west the peak of Baboquivari.

The Mexican found for us the grave of Grosvenor in a dense growth of brush. I had marked the spot with a stone

cut from a white volcanic tufa and had carved on it a brief inscription. On the stone we now found the legend was so well chiselled that I could not be sure that it had not replaced mine.

I knew now that the curtain was again rising on the dark drama of 1861, and that day by day memory would reënact tragedies of those days. In the first of these Grosvenor had been the victim. In every sense a man, and lovable, his career had ended far from wife and children. Mine was then beginning, and with it important phases of education. For one the still standing fragment of my adobe furnace symbolized the end of a struggle to use European methods in metallurgy in Arizona, and the necessity of building anew on a foundation of chemistry in theory, and adapting in practice methods of Pliny, Agricola, and Mexico.

Another phase was the life among the most varied elements of a society living without the restraint of any semblance of constituted authority, a condition that had made possible the murder of my two predecessors and two successors.

We did not succeed in finding the exact spot where Grosvenor was killed—so great a change had come over the surface through cloudbursts burying the old road and destroying vegetation. The Mexican who showed us around the region was killed by lightning a few days after we left.

On the way back to Tucson my left foot gave me some trouble in walking for exercise, and in undressing about midnight I found one of my toes wholly black—so black that I called for a doctor. He said it was gangrene and the toe must be cut off at once.

"I don't believe it," I answered. "I'll wait and see."

"It is surely gangrene, *senile* gangrene," he insisted. "You shouldn't wait. There was a man who came here last year from Seattle with just such a toe. He waited before letting me take it off, and then it was too late, and I had

GRAVE OF H. C. GROSVENOR AT THE SANTA RITA

to amputate at the ankle and again below the hip. I'll come before ten to-morrow."

I went to bed. "At my age a toe more or less won't make much difference," I thought, and slept soundly. When in the morning I told the children, they went to Captain Burgess. He gave the names of doctors to consult, but none of them would meet with mine. On the way back they met and told our head chauffeur.

He laughed and explained: "I saw Mr. Pumpelly drop a big rock yesterday morning. Judging by his language it must have hurt a lot!"

When they told me this, I remembered that I had tried to place stepping stones across a brook near the camp. Standing with my left foot on the low bank and with the right one on a wobbly stone behind, I had dropped a large round stone, and at the same instant my right foot had slipped into the icy cold water. Hence the "language." The cold water had made me forget the little incident of the impact of the stone.

When the doctor came prepared to operate, I dismissed him with his fee for the night call. The next day the toe was as good as ever.

We made an excursion to the old Mission Church of San Xavier, about eleven miles south from Tucson. The road lay along the Santa Cruz River. In my time this stream for forty miles had shown water only where for short distances it came to the surface. A cloudburst on the Santa Rita Mountains would fill the channel for a short time with a roaring torrent, but in the lower stretches it would begin to disappear in the sandy bed, and after the storm, with the diminishing supply from the mountain, the point where absorption by the sand was more rapid than the oncoming supply could be seen to retreat quickly upstream.

In my time the mission and its church had long been

abandoned, for the Apaches had depopulated the region. We found the church repaired and the mission occupied by nuns who taught the neighboring Papagoes. The Mother Superior showed us the church and many interesting things, but most attractive were the birds that flew in and out and sang sweetly perched high in the vaulting. Whether or not the Sister thought that my long beard would lend a spiritual touch, she told my daughters that they should leave me with them.

The country near Tucson, at an altitude of about 2,500 feet, is in the zone which abounds in the saguara (*cereus giganteus*). This unique cactus grows a tall and stately green column with Corinthian fluting, often to a height of fifty feet. It is a bundle of long rods enclosed in a thick, soft covering. The ribs between the flutings bear clusters of long hard spines and hooks. In the season its dome-shaped top is encircled with white flowers followed by a delicious fruit as large as hens' eggs and much liked by birds and Indians. There are large weird forests of these columns. Woodpeckers make big holes to get at the juicy pulp, then the cactus covers the walls of these with a tough lining, making ideal nesting places for the little elf-owl. Hawks perched on the top of the sahuara columns watch for the exit or return of the owls.

In planning the journey I had intended to find somewhere in the high mountains a grassy watered valley with an outlook far over the desert, but we had come too early in the season. As an alternative we decided to strike out boldly to a point about 100 miles distant on the Mexican border where we should reach the "Old Yuma Trail" on which Poston and I had escaped from Arizona. We would follow this for about 150 miles to Yuma. It seemed a simple thing to do with three Ford cars and three drivers. With the chauffeurs we made a party of eight.

RUINS OF MY OLD FURNACE AT SANTA RITA

SANTA RITA VALLEY AND SANTA RITA MOUNTAIN FROM GROSVENOR CLIFFS

Our blankets were in canvas rolls and lashed to the automobile hoods. Tins of gasoline, boxes of food, and cooking utensils were strapped to the running boards and canvas bags of water hung on the sides of the cars.

At first our way lay through a large forest of columns of the sahuara and then came upon the broad Baboquivari plain where I had once seen herds of wild horses—wild for many generations. Expert Apache marksmen caught them by stunning with a shot that just "creased" the top of the neck. Beyond the plain rose the Baboquivari range; and, towering 3,000 feet above its crest, the Baboquivari peak, shaped like a horn, reached 9,000 feet toward the sky, vividly recalling to me the similarly picturesque peak of Monte Baglia Orba in Corsica.

We were now in the Papagoria—the land of the Papago Indians. The general surface slopes gently from about 2,400 feet at Tucson to sea-level at the Gulf of California. Parallel mountains, six to forty miles long, running from northwest to southeast, rise like islands to heights of 1,000 to 4,000 feet above the plains that surround them on all sides.

The average yearly rainfall diminishes from twelves inches at Tucson to about two inches or less near the Gulf of California. Thus in going westward we were going from semiarid through arid conditions to the extreme desert. With this lowering of altitude went also increase in warmth and change in vegetation.

The first day out our head chauffeur gave part of our gasoline to a man in need thereof who said we could replenish at Indian Oases.

Our first camp was among sahuaras by a clear brook rushing down from the high gorges of Baboquivari—the only running water we were to see during the desert journey.

Our daily routine was determined by Raphael's limitations as to absence from his plantation and children. We got up

before daylight. The chauffeurs made the fire; Elise and Amelie prepared breakfast. Meanwhile Margarita sketched with watercolors. After eating we burned the wooden plates, washed the tin cups and packed for travel. There was a short stop for lunch; a quick sketch by Margarita. Camp was made wherever sunset found us, and more sketching. It's a mystery how Amelie and Elise found time to write.

MacDonald, the head chauffeur, a Scotchman born in New England, had a fund of humor. I believe I have abstained from telling any one else's stories, but he had one that I can't help repeating. On a ship nearing the equator there was an Irishman who was anxious to see the "line" he had heard of. Next day the mate stretched a hair from his own head across the lense of a telescope and calling the Irishman said: "Now look quick and you'll see the line." The victim took a look.

"Well, do you see the line?"

"Yes, and begorrah there's a camel walking on it."

Naturally there was no gasoline at Indian Oases. "We would have to go to Ajo," which meant at least a three days' detour. In our disappointment we did not realize that gift of gasoline was to bring luck.

I had heard Poston tell of his discovery of a mountain of copper ore in the Ajo range in the fifties. I knew that much later a herd of camels had been brought from Arabia to bring water there, probably from the forty miles distant Gila River, and that the only result was the failure of the enterprise and the present belief in the occasional appearance of a lone camel in the desert solitudes.

On the way thither we camped one night on a sheep ranch where a large tank was full of water from a deep-drilled well. The water contained great numbers of the larvæ of both the malarial Anopheles mosquito and the innocent variety.

At last we looked down on Ajo. Capital and engineering

were here preparing to create wealth in the waterless waste; wells hundreds of feet deep had tapped reservoirs. We had a cordial welcome from Mr. Curley, the manager of the New Cornelia Mining Company. But there was no gasoline, only a chance that some might soon arrive. It did arrive before night. Both detour and delay at Ajo were doubly lucky, for I learned that for the rest of the trip a guide would be absolutely necessary. With much difficulty I engaged the only Indian who had seen the *Tinajas Altas* on the Old Yuma Trail. These mountain potholes must be reached and water found in them without delay in trying to find them. Tomaso was eighty-five, and his knowledge dated from forty years back. It became evident later that the difficulty with Tomaso was that he was torn between the call of the desert and the risk of braving its dangers with eight "tenderfeet." Three dollars a day and a promise to return him to his home carried the day.

The other piece of luck—less romantic—was that the delay enabled me to see the property, and this led me to telegraph, later from Yuma, to buy a block of stock in the Company which I soon sold for more than enough to pay twice for the whole expedition.

The next day out from Ajo we came to an abandoned deep well where we were to fill our canvas bags with water. Now it seems that new sacks hold water properly only after soaking for two or more days. As ours had been filled less than a day they were fast emptying. It seems also that after hard work in raising a gallon or two out of the well the chauffeurs decided that the water was bad, and that anyway the supply in the bags would last to the next water. They little knew the real desert.

We passed by a mountain range and, leaving the semiarid plains, started merrily into the trackless desert. We entered a garden. The plain far and near was a vast field of yellow

daisies. They were really isolated clusters perhaps two feet high and some distance apart, but seen from a distance they seemed densely massed.

Farther on the plain was equally covered with square miles of pink phlox.

Among these stood "barrel cacti." They look like the sahuara, but thicker and only three or four feet high. Their pulp is often made into an excellent preserve, but its usefulness is in the fact that it contains a great supply of a palatable and nourishing liquid that has saved many lives. It saved mine on these deserts in 1861.

This gave way to miles of tall bunches of plants with small orange-colored blossoms. Then more miles of golden poppies, suggesting a desert origin of the similar California plant; and scattered here and there were tall poppies with large white petals and crinkled, prickly leaves.

After we had passed a party returning from hunting wild sheep near the Gulf of California, two of their guides galloped to overtake us. When they heard we were going to Yuma they said it would be impossible for us to make the journey in automobiles. It had never been done and to fail would be extremely dangerous; but since they thought we would, that year, find water at the *Tinajas Altas* we went on. We heard later that the hunters on their return to Ajo wired to Yuma to send out a party to rescue us.

We soon came onto a sandy plain where we had to walk to relieve the cars. Here abounded all sorts of cacti with long needles that were so hard and slender that they pierced through shoes and leggings. I happened to sit down on one of these "devil's pincushions." It took the party a half-hour to "pluck" me.

Before long worse things began to happen. We had come to a region where cloudbursts had cut broad shallow channels in the sand plain. They varied from a few yards to several

rods in width, with banks a few inches to a foot or more high. The first of these was very low, but it took a long time and hard work to get one machine after another over the banks with the aid of the engines and with all hands pushing. The water was low in the radiators and in the sacks. The dry air was hot and nine throats were thirsty. Tomaso examined the water supply and looked anxious. Then we came into a channel with higher banks, where we stalled. No amount of effort availed. Tomaso said we must not drink water. He had already refused it for himself.

There was clearly an element of real danger in our situation. An examination showed that many similar obstructions lay before us. Our sacks were losing water; so, too, were three radiators. Unless we could find some way to avoid this stalling we should die of thirst, for on the dry desert one cannot live two days without water, nor could the automobiles.

Fortunately I remembered having brought twelve yards of wide canvas to pull over us at night if it should rain. This we stretched so that the bank was under the middle. Then with one man driving and the others pushing we triumphed. As there had been no rain that canvas would probably have been left by the way if the drivers, being afraid of skunks, hadn't slung it, like a boat, between two cars to sleep in. By its aid we got over the bad tract and before dark came on to the smooth hard floor of a *playa*. Here in 1861 a cloudburst had saved the lives of my party. We were now on the Old Yuma Trail.

It was probably on the bad stretch just described that, shortly after our experience, three men tried to cross the desert in an automobile. Two of them died, and one was strong enough to reach a point where he was rescued in an exhausted condition.

The *playa* is almost surrounded by a great lava flow which, starting from the almost inaccessible Pinecate Mountain near

the Gulf of California, covers an area about forty miles in diameter. It was on this lava that we camped near one of the great number of slag cones scattered over the flow. The cone that stood near our camp was, perhaps, 200 feet high and was hollow. The lava field was evidently very thick; the surface had hardened while the liquid interior continued its onward progress. The cones were immense bubbles produced by the escape of confined gases.

We felt that we were now out of danger. We were on the trail and only about fifteen miles from the *Tule* well.

This camp on the lava field was one of the most attractive of the expedition. There were none of the desert trees—leafless *palo verdes* and *palo fiero*—but there were great masses of flowering plants and some beautiful white lilies. And there was, scattered here and there, the strange *ocotillo* with its many slender, branchless stems, nearly ten feet high, radiating from one root, each stem bearing one scarlet blossom floating like a pennant at the top. Eastward beyond the lava field and its cones, and far away over the desert plain, crumbling mountains shone red in the sunset glow.

When night had closed over the wonderful scene, I looked back over our two weeks of desert life and the effect on my children.

With our entrance into Arizona a new spirit seemed to enter into my party. The region itself in its scenery, its vegetation, its atmosphere forms a unique corner of the planet. In these features it stands apart from all other landscapes—even from all other deserts. As a variant it is an unreal world—a dream world. This idea was ever present, and it became more impressive as we moved from the higher and cooler to the lower and warmer altitudes—to the real desert and its still more specialized and weirder plant forms and more brilliant coloring.

The mood of the desert is never sad. It is either entranc-

ingly smiling or terrifyingly grand; radiant in its ephemeral garb of flowers and in the golden silence of its bare plains and tinted mountains; awful at night when hell is let loose, storm rages on the heights, the cloud is alive with forked lightning and the heavens reëcho incessant thunder.

But it is the smiling mood that leads the unwarned or unwary astray, or lures to the tree-fringed lake to find only sands and death.

Few can resist the spell of the desert or willingly neglect its call in the stress of ills of body or of soul. The geologist McGee, in the extremity of nervous breakdown, sought and found new life on the Old Yuma Trail.

Raphael, like me, had come under the spell of the deserts in Turkestan, on the Gobi, and on the Pamir. He had known them in all their moods and had portrayed these in good verse. With the others the sense of novelty soon yielded to the all-absorbing charm of the life and its surroundings. They lived in a state of exaltation that never wavered and that in Margarita found expression in painting, and in Elise in emotional verse, and in Amelie's journal.

There was no thought of hardship in the rough food, tentless nights on hard ground, or in cooking and dish washing. To them all such incidents were merely harmonious parts of an idyll.

To me the desert meant all this and much more. Alone, in the great solitudes of mountain heights, I had felt some subtle influence lifting me to a medium beyond the bounds of self to a clearer perception of relations and values in life. Such experiences have deeply affected my attitude toward the spiritual in life. I do not think of them as being merely subjective conceptions. It is in the great wildernesses, on lofty heights and on desolate deserts, that one feels the greatness of Nature's mysteries. In the starlit heavens mind outruns vision into ever deeper depths of infinity until in

exaltation it is raised to a higher level of spiritual consciousness.

It was among these aspects of Nature, and through their influence, that began all the spiritual and material changes from savagery to civilization. On the oasis of the great deserts of Asia gods took the place of spirits, agriculture replaced hunting.

It was on the desert and on the heights of Sinai that, out of a semitic tribe, Moses forged the Jewish nation and formulated its religion and its laws.

Thus it is to the wildernesses that we owe both our spiritual conceptions and the fundamentals of material existence. In the decadence of faith, in anxiety or grief, one may still seek counsel and strength in those silent realms of Nature.

The next night we camped at the abandoned *Tule* well. Its water was both brackish and offensive, but on the desert one may not be squeamish. Several months later a friend who had been over that route on a survey asked:

"How did you like the *Tule* well water?"

"Not much," I answered.

"Naturally," he said, "for we found and left a man in it two years ago."

From there to the *Tinajas Altas* we passed between granite mountains that were disintegrating into the weirdest of desert rock forms often deeply honeycombed by sand blasting.

The *Tinajas Altas* (high tanks) are a series of holes one above the other on the side of a bare granite mountain. They seem to lie in a crack rather than in a ravine, and the ascent from one to the other is a dangerous climb up a precipice. My son found eight or nine of these holes full of water, for during the last two years there had been many cloudbursts on the mountains, and unusual rains over all Arizona. Ordinarily the holes are dry unless there has occurred a cloudburst within a few weeks. In 1861 they stood half-way

LAS TINAJAS ALTAS. THE LOWER TANK

From a photograph by Captain D. D. Gaillard

in a waterless stretch of a hundred miles or more, and to find them empty meant almost certain death to man and beast. This was the chance Poston and I had to face, and we were saved by a downpour on the *playa*.

It is a matter of history that more than two thousand persons have died of thirst and exhaustion on this part of the "Old Yuma Trail." I remembered now, too well, tales about these potholes to dare to peer towards the bottom; the surface swarmed with larvæ of mosquitoes, malarial and others.

The lapse of half a century had wrought a great change. I had seen on the trail along the base of the *Tinaji* range, near the potholes, great numbers of dried carcases of cattle and horses that had died there of thirst, on their way to California, when gold was abundant and meat almost unobtainable. Of these there was now no sign. They had been buried under débris washed by cloudbursts down from the ever-crumbling mountains.

Only Raphael succeeded in reaching the upper holes, where at the top he took a panoramic photograph. There, too, he found the sun-cracked horns of the bighorn.

Although it was early in March the mercury stood at over 100° F. In September, 1861, it marked 126° in the shade.

In the north of the *Tinajas Altas* a low pass across the *Tinaji* range opened the way to the great Yuma desert that with a width of fifty miles to the Gulf of California extends more than a hundred southward. Great dunes of sand, said to be 200 to 300 feet high, extend through its length and bank high on the west slope of mountain ranges that protect the deserts to the east. These we could see from heights near our camp at the west end of the pass, and, far away over the golden desert, the mountains of Lower California; and to the east the view was bounded by a long red and purple-painted

range with a black volcanic peak rising midway, rightly named Cabeza Prieta (black head).

In 1861 our trail ran thirty miles on the east side of the mountains to the Gila River, but the later discovery of a gold mine, supplied by water from the high mountain, made possible a route on the west side. Without this watering place we could not have got through to the Gila, so fast did our supply vanish and thirst increase. One car gave out and had to be left with its driver to make repair.

At last we reached Yuma. And now there was a real city on the very spot where Poston's ready wit had led him to survey an imaginary city in order to pay the ferryman in corner lots. We drove through good streets, where the goods behind big plate-glass windows betokened families of rich farmers.

In the old days this region was the land of the Yumas, a particularly savage tribe armed with war clubs and bitter enemies of both Papagoes and Apaches. Many of them swaggered along the streets and showed unwelcome interest in Tomaso, who was anxious because he was off his tribal ground. So we planned to protect him till he should take the train to go home.

We made a sorry looking procession into a large and comfortable hotel. The sun had burned the skin off the back of my hands. The girls hid, behind thick veils, lips swollen to exceed in size those of a Congo venus.

That night Raphael and Amelie started homeward, taking Tomaso as far as Gila Bend, whence he could reach Ajo by stage. The old man, with his money well stored out of sight, left us with a more smiling face than one often sees on an Indian. He was a fine specimen of the old time agricultural Pimas.

The next day we, my two girls and I, started for Phoenix on the way to Globe where I wanted to see the Miami mine,

not so much on account of my interest in the mine as an excuse to see the country and the Roosevelt dam.

In order to cross the Gila River we went up it to Dome, passing, on the way, through the spot where, in the old time, Poston and I and the rest of the party weathered through an all-night sandstorm that, in pitch darkness, threatened to bury us.

A rickety ferry boat managed to get us and the cars to the opposite bank.

We had left the golden desert, its painted mountains, its mysteries and dangers, but we already felt the call to return, and if we had still had Tomaso with us we could hardly have resisted the temptation.

The desert through which our route still lay had lost its mystery and charm through the building of an automobile road and other evidences of vulgarization. Only the distant mountains reigned in pristine grandeur. On one of these, in the far distance, the skyline was broken by Castle Dome, an immense flat-topped and cliff-bound rock standing high and "four square to all the world." Like Baboquivari peak it was one of the great landmarks of Arizona. During all that day and much of the next we camped late where "devil's pincushions" and scorpions contributed to the interest of the place and suggested the possibility of snakes. From here our way wound between high cliffs, half-encircled the great crag of Castle Dome where was once an Apache stronghold, and on to where, among volcanic hills, there were hot springs and an inviting inn. Beyond this we camped in the twilight on some ground full of holes where I silently suspected we might be trespassing on rattlesnakes, but I trusted to the coolness of the night and said nothing.

At Phoenix I sent the cars back to Tucson and we took passage in an automobile stage to go to Globe. As I had a back seat for eight hours in an overloaded machine, with

weak springs, and with a heavy casting on the rack behind, memory recalled attempts to break a bucking mule. Even this could not prevent my realizing that our road lay through some of the most majestic scenery in America. Also it looked down on the Roosevelt dam—a triumph of engineering, built to irrigate over 200,000 acres of desert.

At midday we ate at a wayside house. The dinner was good and the atmosphere so homelike that instinctively I scanned the wall for the motto "God Bless Our Home." Another motto was there. It read:

"Stop Your Kicking."

At the Miami mine, with the manager, Mr. Gottsberger, I saw the plant and we all went underground as an experience for the girls.

In returning to Phoenix the narrow road made a tortuous descent for many miles, unprotected along a precipice. For danger it beat the *Cornice* above Monaco, but we tore down at full speed and on two wheels around corners. The driver knew his road. We wished we knew more about the driver.

Two days were passed at Phoenix where we met Judge Kent and Mr. McClintock, who were both authorities in the early history of Arizona.

Our motor travel had ended; henceforth we were humdrum tourists. To go to California we had to wait an hour at Maricopa where Margarita painted, Elise wrote, and I found astonished interest in the Santa Cruz River which in my time had kept modestly hidden and was now boldly roaring for a hundred miles to join the Gila. Incidentally it had appropriated a nice slice of Tucson, and recently, aided by a cloudburst on the Santa Rita, had destroyed a stretch of the railroad where I now sat.

Beyond Yuma we entered the Colorado desert which in my time was a real and, by many bones, well certified desert

[illegible] and with a heavy casting on the [illegible] memory recalled attempts to break a bucking mule [illegible] not prevent my realizing that our road [illegible] some of the most majestic scenery in America. Also [illegible] down on the Roosevelt dam—a triumph of engineering [illegible] to reclaim over 200,000 acres of desert.

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SUNRISE NEAR AGUA CALIENTE

From a water-color by Margarita Pumpelly Smyth

lying nearly three hundred feet below the ocean level. Later some one dug an innocent looking ditch to coax water from the Colorado River for irrigation. Warm climate, water, and rich soil combined to make a magic garden. This was called the "Imperial Valley" of which a friend writes the name was *La Palma de la Mano de Dios* (The Hollow of God's Hand). Fortunes were invested and all went merrily until the spirit of the great river took vengeance and, undermining the ditch, broke forth to form the deep and broad Salton Sea and drown the new Garden of Eden. The inflow has been stopped after great effort, and the sea is slowly evaporating.

Will our Government and the people along the lower Mississippi heed the lesson? China learned it many centuries ago. The silt deposited by the Yellow River raised its bed above the bordering plain and the river had to be confined between levees which had to be raised as the bed rose. From time to time breaches occurred and the river flooded the plain far and near, changing its course to shift its mouth hundreds of miles on the coast. These floodings destroyed whole populations, produced famines and revolutions that swept away dynasties. Where the river enters the plain its bed is now over one hundred feet above the city of Kaifung. The silt of the lower Mississippi has raised its bed above the fertile plains that border it. It will continue to raise it and the population will become more and more dense, and there will happen the worst of the things that have made the Yellow River "China's Sorrow,"—unless there shall be evolved a system of control by changing the course or by some great feat of engineering other than temporizing methods.

A day or two at Los Angeles and the surrounding country showed us what wealth and energy can do in converting a desert into a city of luxury and comfort encompassed by gardens of fruit and flowers, yet miss the charm of the old Spanish settlement and mission of nearly sixty years ago.

Two or three days under the friendly guidance of our Dublin neighbors—Mr. and Mrs. Francis M. Jencks—introduced us to Santa Barbara, the loveliest of seaside places and its old Spanish Mission. We were on our way to the Panama Exposition at San Francisco. When we got there towards evening, in order to make it most easy to get a maximum amount of mental improvement, we put up at the "Inside Inn." It was a nice inn and crowded with other guests apparently on a similar quest. After dinner much of the night passed in being fascinated by the enchantment of the fairy scenic effect of architecture, color and lighting.

In the morning we started zealously on a tour of the exhibition. In the beautiful arts building I remember only that we liked the charming little bronzes by Manship and paintings by Duveneck. A lunch at a Japanese restaurant convinced us that we needed real refreshment, so we sought the "Zone"—a long street of side shows. A walk down that avenue made us children again. It was a progress through a delightful pandemonium of discordant bands drowning the shouting appeals of touters for countless "wonders." As children we sacrificed dimes, quarters, and half-dollars to find a predominance of fakes. Then we took them in one after another as a gamble on the chance of seeing something worth while, or of seeing how little was really needed to gull grownups.

As the next day was to be the last before going eastward, we decided to do our duty as grownups and devote our intellectual energies to the exhibits and demonstrations in the buildings. The structures and grounds and waters and crowds were so interesting that we loitered through them and would do the insides on the way back. When we got to the turning-back point we were at the entrance to the "Zone" and yielded to the temptation to rest by taking a last look at it. For a chance to sit down we looked in on the "Edu-

cated Horse," which was worth a half-hour, and on the Hawaiian Diving Girl; that was worth another. Then we hurried on our way to see the exhibits. Alas for Margarita to try her hand at shooting to hit the lighted windows of a toy train moving slowly along the back of the booth! Her enthusiasm lasted a half-hour, then we made a really determined fresh start, and ran right up against fate and rejuvenated. We lost an aggregate of about one hundred years of age. At the back of a booth was a stage with a door at each end. Out from the door at the right end came in single file eight delightfully dilapidated, life-sized bums who proceeded slowly across the stage and disappeared through the door on the left. You paid ten cents for five shys at the hats on the tramps. This was really worth a half-hour and left us both hungry and late for luncheon at the inn, so we left the exhibits till after eating. When at last we started on this tour it occurred to us that we hadn't seen Chinatown and we were to leave that evening. But Chinatown had been expurgated by quake and fire, and we realized that we had made a mistake in preferring it to the exhibits we had come so far to see.

After all, considering that we were idealists, did we not get the best of the exhibition—delight in the beauty of the externals and childish fun in the "Zone"?

We had intended to pass a week in the Yosemite, but it was too early in the season, so we went to the Grand Canyon of the Colorado River. We arrived early and after breakfast mounted mules to descend the Bright Angel trail to the river that looked like a brook a mile below.

The trail was just wide enough for one occupant, except at turning-out places, and was much of the way between a cliff on one side and a precipice on the other.

The trip down took about four hours. I had seen even more dangerous trails. I knew, from experience, that the

mule, being a pack animal, keeps his hind part away from the mountain side, because bumping his pack against a rock or tree might send him over the cliff. But what occupied my mind much of the four hours was wondering if the mule knew that his outer hind hoof was always treading the uncertain edge of a precipice.

There was still snow at the top of the trail. The mercury marked nearly 100° F. in the shade at the river.

The next day we drove on the edge of the canyon to points that offered grand views. Even if it were not generally known to tourists I would not presume to attempt a description of almost the most wonderful of natural phenomena. I carry away only the memory of a vast abyss between lofty receding cliffs. It is on such an enormous scale that we must live by it, feel it.

Its grandeur is colossal, its veiled secrets infinite; a great solitude, a temple of God.

The only stop on the homeward way was for a few hours at Niagara—still new to the girls. The ice was breaking up below the falls and it seemed strange to see sentries patrolling the bridges and the approaches on the Canadian side. They were, however, quite ready to talk, and allowed us to take certain photographs.

Goat Island was sadly changed. It was sacred in my memory. Nearly fifty years ago my wife had been desperately ill at Niagara, and, after nightly vigils, in the dawning of days of May I had sought courage among the stately beeches and the song of mating birds.

So, too, is the desert sacred in our memory, for in it we sought and found comfort after a great loss.

RAPHAEL PUMPELLY WITH ALL LIVING CHILDREN AND GRAND-CHILDREN AT THE STUDIO WINDOW AT "ON-THE-HEIGHTS," 1917

From a photograph by Elise Pumpelly Cabot

CHAPTER LVI

HEREDITY, ENVIRONMENT

LIFE is lived subject to the control of heredity and to the influence of environment. Heredity delimits the extent of potential ability, while the development of this is favored or retarded by environment.

The progress of life is a continuing movement out of the light of the present into the darkness of the future, along a route with forkings branching out into mystery. It is in the conscious or unconscious choice between such branchings that the trend of life is determined subject to the play of environmental influences.

My mother's ancestry in all its strains, since arrival in America, goes back mostly through six generations to before the middle of the seventeenth century. Excepting William Pynchon and his son-in-law, Edward Holyoke, all the lines settled in the Connecticut valley in Connecticut. Through intermarriages all these generations are represented by only twenty instead of sixty family names—male and female. At least thirteen of these families had coats of arms.

In three double and two single strains of descent, all combining in my mother, sixteen of these family names represent all of my mother's cis-Atlantic ancestry.

In the direct line they contributed one Colonial Governor, Thomas Welles, eight assistants—members of the Upper House—ten Representatives, three Patentees, under the charter of Charles II, and three Commissioners of the Federated Colonies of New England. In the collateral lines they contributed eight Colonial Governors.

The Governors of four of my mother's ancestral families—Welles, Talcott, Pitkin, and Treat—constituted four out of twelve in the Colonial period and held the office thirty-nine out of one hundred and thirty years (1639-1772).

In such a genealogical series one would seem to have a chance to study heredity.

That at least eighteen of these ancestors were eminent in the sense that Galton uses the word is shown by the high offices they held, but this may have been partly due to the social position of their families; for most of them belonged to the class whose sons at Yale headed the list in the yearly catalogue.

Members of three families—Welles, Talcott, Pitkin—held office during an aggregate of fifty-two years as Treasurers of the Colony, and two hundred and sixty-four years as members of the Upper House (1639-1818).

Since more than half of the families represented in my mother's American inheritance formed an important part of the group of leaders who established the Colony, made its constitution—called the "Mother of all the Constitutions"—and made and administered its laws, they must have been men of marked ability. They came of good old English families. Names from twelve of these occur in the "Dictionary of National Biography" (England) from the thirteenth century down. They are also largely represented in our much less selective biographical dictionaries. But I have the impression that since Colonial times they have produced few men of very conspicuous ability in the male line except Jonathan Edwards, Gideon Welles, President Lincoln's Secretary of the Navy, and David A. Wells, who was elected to the French Academy to succeed John Stuart Mill.

My mother descended direct from Richard Edwards, the grandfather of Jonathan Edwards, and her grandmother was

first cousin to the great metaphysician, but here, to use an Irish bull, I, perhaps, just missed it. For Jonathan's grandmother, Elizabeth Tuthill, was the first wife of Richard Edwards; my ancestress was the second wife. I might have come down as did Jonathan from the first wife if she had behaved properly, but it seems that she did not. She was a woman of strong character, fine presence, and very gifted, but after she had borne her husband seven children the general court, for obvious reasons dating back to before her marriage, gave him a divorce and he married my ancestress, Mary Talcott.

A writer on heredity holds this first wife up as a warning to eugenists, who, if they had existed at the time, would have sterilized her, and thus cut off America's most brilliant line of descent.

In the seventeenth, and much of the eighteenth, century the opportunity for development of ability was restricted to a somewhat narrow field—Government, the intricacies of theological thought, the industries of the time, and the protection of family and state during continuous wars.

My best chance for inheritance lay in the double strain of Pitkin descent, for four generations of William Pitkins were Chief Justices of the Colony during much of the time for a period of one hundred and twenty-five years; and this family produced in the male and female lines six Colonial Governors, and five were Magistrates—members of the Upper House—between 1769 and 1840.

Of my father's line I know only that his father, John Pumpelly, was born early in the eighteenth century, that he was brought up by his grandmother and ran away to sea when eleven years old, and that as I saw on muster rolls, he served from 1750 to 1760 in all the Colonial campaigns from relief of Fort William Henry to expulsion of the French from Acadie and the battle on the Heights of

Abraham. He was in Rogers' Rangers and the only survivor of one of that bodies' scouting parties up the St. Francis River. I remember well my father's thrilling account of how this party, after surprising and destroying a band of Indians in the night, lost their way, and, getting scattered, nearly all died of starvation. He was the last of a small group when lying exhausted he heard the sound of an ax and struggling a few rods further was rescued by a settler. He had wandered to near what is now Bellows Falls on the Connecticut. During these campaigns he rose from drummer boy to sergeant.

I find him again in Nova Scotia in 1760. Here he showed his tendency to romance and adventure by carrying off on his saddle a girl who had attracted his fancy, and riding all night to a town where they were married. There was some mystery as to the girl's origin. She was of Dutch extraction and brought from England as the ward of a Dutch pastor. Later he was engaged in making cannon and was commissary in the Revolutionary War. His second wife, my grandmother, was a Bushnell and related to the Rev. Horace Bushnell, and the David Bushell who made the first submersible boat to blow up a British warship in the Revolution. The attempt failed because they could not attach the bomb to the copper-bottomed hull. For his submarine Bushnell invented the conning tower, the propeller, and the first suggestion of a torpedo.*

John Pumpelly's father was a Huguenot, and commanded a ship that made voyages to France where he visited relations who had a chateau. He was drowned by being knocked overboard by the spankerboom of his ship during the infancy of his only child. This is all the authentic information I have. There is a tradition that the family came to Avignon from Italy with one of the Popes or anti-Popes, and it became

* *The Story of the Submarine*, by Farnham Bishop, 1916.

Huguenot. The Pompili family is very old and still existent in Italy. There is another tradition that it came from Dijon.

My father was tall, erect, and of fine figure. He was sympathetic and affectionate in his family relations, and abstemious and simple in his requirements. Intellectually he had good judgment in business matters, was often sought for counsel; and he possessed a critical discernment in his reading in history and poetry. Physically and mentally he was absolutely normal.

From my mother I received the gifts of a strong imagination and power of visualizing—qualities essential in the interpreting of observation and in correlating these in forming working hypotheses.

I have from childhood always had a tendency to see both sides of a question, and the other man's side as well as my own. I think this may have come through my mother from the double strain of descent from the Pitkin Chief Justices.

This may be supported by my mother's inheritance of certain physical traits traceable to the same source. One of these was an exceedingly sensitive skin on the face. In a letter of the early part of the last century from her brother at the seashore he complains of the effect of salt water on his "sensitive Pitkin skin." It had become traditional in the family; the only Pitkin man I have seen had it very markedly. Two of my mother's great-grandmothers were Pitkin sisters.

While I did not inherit from my mother her artistic talent, my daughter, Margarita, doubtless, received her great artistic talent from her Grandmother Pumpelly.

But as regards heredity the main fact is that the records show that almost every one of my mother's cis-Atlantic ancestors in the direct line held one or more high offices and that this was true of the collateral lines. This, considering

the character of the people and standards of the time, meant a rather high general grade of stock and ability.

From my father I inherited a sense of responsibility and of charity in judgment of others, and whatever the quality is that has kept me through life moderate in the use of alcohol. From his Huguenot ancestors my father may have inherited the qualities that made him and his brothers uniformly respected both for successful achievement and uprightness of character; and from his father I may have derived my love of adventure.

Environment

This book is itself a record of the environment in which I have moved, but I would point out some of the more critical controlling factors. In looking back over eighty years I seem to have moved along the lines of least resistance excepting where questions of honor and responsibility to others necessarily shaped the course of action. A happy home life in the country in childhood and the arousing of my imagination by my mother in connection with the wonders of geology were important factors. A chance remark of my schoolmate, Dunham, sent me to Europe where three years of roving life, without school, instead of being disastrous became the most valuable period of my education through the stimulus imparted by my mother toward natural history.

The coincidence of a newspaper notice that led me to a scientific meeting in Vienna and to the friendly advice of an eminent geologist sent me to study three years at Freiberg and decided my career.

After returning to America an incidental meeting with the geologist, Colonel Jewett, at Albany took me to Arizona and, in escaping from there, the failure of a ship to come to a port on the Gulf of California forced me to risk the Old Yuma trail over the desert and go to San Francisco instead

of around Cape Horn to New York. From this resulted my engagement by the Japanese Government and the whole series of adventures and explorations in eastern Asia. My second return to America finished an eleven years' education in science and human nature.

It was an ever-growing interest in geology and the allied sciences that saved me intellectually and morally from the ruin that menaces youths left to drift as I was; and the thread that guided me through and out from that labyrinth, was spun by my mother from the distaff of Hugh Miller, illuminated by her own imagination.

During thirty-five years of professional and administrative work every engagement came as a result of a chain of coincidences. I don't remember declining an undertaking or of failing to carry it out to the best of my ability. The reason is that there were few things that did not present an attractive side. Every opportunity that came to me came unsolicited except in the few cases in business when I put up my share in money or its equivalent. I never even hinted that I would like to belong to a club or society, nor did I ever ask for or present a purely personal letter of introduction after the incident with Sir Charles Lyell.

If I accepted direction of a State Geological Survey it was because there was in the state some important problem to be worked out in detail. I undertook the non-precious mineral part of the U. S. Tenth Census not from love of statistics, but because it seemed important to obtain and publish a geological and economic description of every occurrence of iron ore in the United States, from Canada to the Gulf and from the Atlantic to the Pacific, together with specimens and commercial samples for analyses. Nothing of the kind had ever been attempted. The work of planning and organizing always had a fascination. It differed in each case, but I quickly visualized the whole plan in its broad details.

In the journey of my life there was one forking of the ways where perforce physically I followed one route and mentally the other as well. The signpost was the two little statements that in 1863 my Chinese scholars had gone out of their prescribed way to extract from a map in a Commentary upon a work of Confucius. For forty years my mind was ever looking forward to the time when I might try to lift a corner of the veil that hides the old world, and get a glimpse of prehistory and of European origins. At last when this seemed hopeless, when nearly seventy years old, two things happened. The landed investments I had made in my youth, as a sheet anchor for old age, came to the front enabling me to pay off a large debt, and the Carnegie Institution financed me for the expeditions to test my hypothesis in Central Asia.

With these two happenings there opened before me a new world and a new youth.

Although the archæology of Central Asia was an untrodden field I had to read widely in that of Chaldea and the Mediterranean and European spheres, and with grammar and dictionary to translate Russian writings on the geology and physiography of Turkestan. It was a new education. The seven years of study, of field work, and of editing my own and my collaborators' work were the happiest of my life.

And when it was all printed I put my copies away on a shelf and gave no more thought to it. I had made good the long dream. There had been seven years of high pleasure. Why court trouble in looking for praise or damnation or ignoring and to this day, for nine years, I never have looked. Archæologists and historians in Europe have sent me their books containing references or quotations from the volumes, or reviews, some with praise, one or two quite otherwise.

There was one very important critical forking of the ways when one of the signboards said "Opportunity" and where

I forced myself to follow one which gave no promise. This was when for reasons already related I refrained from buying all but two of the even sections of the Gogebic iron range—tracts that since then have already produced many million dollars of royalties on iron ore. Yet I have never regretted that decision. To have decided otherwise would have meant a different route of life and its forkings and uncertainties—one that might have led to disaster instead of along the lines that have led to usefulness and happiness.

From the time I first met my wife she was, throughout the forty-six years of our joint life, the most important factor in my environment. In our harmonic union the soul that enlivened her great beauty of form and features, and a quick and wise intuition, exerted a strong spiritual influence on my character. She had a highly artistic and poetic nature, and a retentive memory that developed a critical appreciation of the best in art and literature. She had a reading knowledge of Latin and French and read and spoke German. Under the influence of her father she began early a profound study of Shakespeare, and many good critics enjoyed, in private circles, her own remarkable renderings of Queen Catherine, Lady Macbeth, Ophelia and Portia, recited in a voice of exceptional charm.

In the essentials of character the gentle influence of my wife extended beyond me to our children, to whom she also transmitted, from her own inheritance, the best traditions of loyalty to ideals that make for good.

TURCOMANS EXCAVATING ANAU

MOSQUE AT THE RUINED CITY OF ANAU

APPENDIX I

TURKESTAN

Two weather-wasted and rounded *kurgans* rise from the surface of the Anau oases, a northern mound forty feet and a southern one fifty feet high. They are 2,000 feet apart, and about 5,000 feet to the east stands the ruined city of Anau abandoned in 1844. We began excavation first on the northern mound, and later on the southern one, with gangs of Turkomans to whom we paid from twenty-five to fifty cents a day. Work began at 4 A.M. and lasted till 5 P.M. There was an hour at eight for breakfast, and two at noon for dinner and siesta.

Dr. Schmidt selected the points of attack on the top and on the sloping sides. At these places pits fifteen to twenty feet square, with vertical sides, were sunk, always keeping a level bottom, of which the height above a datum point on the plain was daily determined. The rate of downward progress was from one to two feet daily. A close watch was kept to save every object, large and small, that had belonged in the daily life of the former inhabitants, and to note its relation to its surroundings. I insisted that every shovelful contained a story if it could be interpreted, for in the whole mound lay the history of the civilization of which it was the débris. In every pit there were baskets into which went the potsherds and coarse objects collected during the day, and these objects were daily marked with number of pit, date, and height above or below the datum point on the surface of the plain. In this way all finds carried their vertical and horizontal position in the mound. Much of the earth was screened to save small objects which the finders kept through the day in small bags.

It was one of the delights of the expedition for the whole party to gather every evening around a long table in the dining *kibitka,* when each one produced his small finds to have them examined, recorded, and passed about among the members.

To summarize briefly the results of work on this *kurgan:* We found that it had been a village. Walls of sun-dried bricks inclosing rooms and closets showed that the people lived in houses. The settlement, growing slowly upward, stood always upon its accumu-

lated débris. From its beginning, at the level of the plain, everything that came into it that could not decay remained—the earth to build and repair the houses, stone utensils, broken pottery, bones of the animals used for food.

The rate of upward growth must have been nearly uniform throughout the occupation of the site, because it depended almost wholly on the amount of earth brought from without to replace the wastage, through wind and rain, of the clay in walls and on roofs.

The abundance of bones suggested to me the possibilities that they might throw some light on the origin of European domestic animals. So I had special baskets to receive them in every pit. Each day's finds of bones were sorted and marked with date, place, and height above datum for chronological, as stratigraphical sequence. These, weighing over half a ton, were sent to Dr. J. U. Duerst, a comparative anatomist at the University of Berne.

Parallel with the growing elevation of the *kurgans*, but at a slower rate, went a rise in the surface of the plain caused by the annual depositions of alluvium and the bases of the two *kurgans* stand now about twenty feet below the level of the plain; therefore their real height from their bottoms is respectively sixty and seventy-two feet.

The ever-increasing height of the earthen floors above the plain is shown by the renewal of fireplaces with their ashes and broken bake pots at vertical intervals of a few inches.

Fifteen feet below the top of the mound a horizontal layer of burnt earth marks apparently a conflagration, and certainly a change in occupation. Below this dividing plane my shafts showed forty-five feet of culture débris.

This older civilization—which we will call Anau I—was marked throughout by coarse and fine handmade pottery of which the technique and simple motives of decoration were peculiar to it and by the absence of copper—it belonged to the Neolithic or Stone Age.

That the upper fifteen feet—Anau II—consisted of the débris of a succeeding and intruding occupation was shown by the different technique, decoration motives, and forms of its fine handmade pottery. The occurrence of a very few small articles of copper showed that this civilization belonged in the beginning of the Copper Age.

The southern *kurgan* was attacked in the same manner as the northern one.

Here we excavated with pits only in the upper thirty-four feet; below this we were able to explore only with four shafts.

From the base up to a height of sixty feet the accumulated strata belonged to the occupation of one civilization—Anau III—strongly characterized by the fact that its pottery was wheel-made in different forms from those of the north *kurgans*. It was marked also by an abundance and variety of copper implements, of which only a few specimens were found in the neighboring mound. This *kurgan* was clearly founded after the abandonment of the other. Anau III was of the Copper Age—the forerunner of the Bronze Age.

This civilization ended with a conflagration. Its ruins are buried under ashes and eight feet of irregular débris that seems to mark a period of uncivilized occupation.

On the top of this are four feet of the remains of a people who used iron—Anau IV.

The neighboring city of Anau seems to have been founded about the fourth century A.D. Its ruins are of houses built of burnt bricks, and the remains of a beautiful mosque dating from 1444 A.D., according to a Cufic inscription. Here we made only slight exploration by five shafts to observe the character of its pottery.

The accompanying table shows some of the things found—those of chief importance in interpreting the daily life of the settlements, the character of their civilizations, and their relation to each other. There came to light abundant objects—none remarkable for beauty—but their exact place in the upward growth of the mounds being known they form invaluable historical documents.

NORTH KURGAN

N.K. Anau I, Stone Age	N.K. Anau II, Transition Age
Houses (unburnt brick)	Houses (unburnt bricks)
Children burials in houses "in contracted position" with gifts	Children burials in houses "in contracted position" with gifts
Spindle whorls	Spindle whorls
Flint elements of sickles	Flint elements of sickles
Turquoise, Lapis Lazuli } Beads	Turquoise, Lapis Lazuli } Beads
Stone Mace-heads	Stone Mace-heads
4 small objects of copper near top of Culture I May belong to Culture II	Copper 4 small objects ("dagger or spear head found on surface." May be later)
Metates	*Metates*
(Stones to grind grain)	Sling-stones Flint knives
Agriculture Domestication of animals	Agriculture Domestic animals
	Carnelian beads
	Stone weights (heavy)
Pottery hand-made and painted	Pottery hand-made and painted

SOUTH KURGAN

S.K. Anau III, Copper Age	S.K. Anau IV, Iron Age
Houses (unburnt bricks)	Houses (unburnt bricks)
Children and adult burials in houses "in contracted position" with gifts	
Spindle whorls	Spindle whorls
Flint elements of sickles	
Turquoise, Lapis Lazuli } Beads	Turquoise, Lapis Lazuli } Beads
Stone Mace-heads	
Copper. 29 objects, including 7 daggers and knives, a sickle and a razor	Copper arrow point (three-edged)
	Iron sickles
Metates	
Sling-stones	
Flint knives, saws, and scrapers	
Agriculture Domestic animals	Agriculture Domestic animals
Carnelian beads	
Agate beads	
Stone weights (heavy)	
Arrow-heads of flint " " " Obsidian (beautiful workmanship)	
Pottery wheel-made (some coarse hand-made)	Pottery wheel-made
Clay figures of Ishtar	
Clay figures of bulls or cows	
Seal (three-sided with man, lion, winged and bird-headed lion-griffin)	

This table shows that in each civilization the people lived in a village, which means social organization. In each mound the later comers built on top of the earlier occupation. This was partly for defense, and partly because in summer each foot of elevation above the fiercely heated plain gave added comfort; but, doubtless, also because of the value of land for cultivation on the restricted area of the oases. The limit of elevation was probably determined by the difficulty of carrying water.

The manner of discovery that they were agriculturists is interesting. Professor J. U. Duerst of Zurich, to whom I sent the bones from the excavations, happening to find in one bag a piece of burned clay that had holes containing a white powder, turned the fragment over to Professor Schellenberg, a botanist, who found, under the microscope, that the powder consisted of the siliceous skeletons of the chaff of a primitive variety of wheat, and of two-rowed barley; and casts of the holes gave the forms of the chaff of both cereals. I went to Zurich and found that the fragment was part of a kind of large, coarse jar of the oldest occupation of the north *kurgan*. Then I went to Berlin where the pottery was being studied, and sent to Schellenberg a piece of the same kind of jar from the very lowest layers of the mound. This was examined with the same result. That particular kind of jar was made of clay mixed with chopped straw, of which imprints showed all over the surface of the vessel. It happened to be the only kind of pottery in which straw and chaff was used.

This discovery proved that the people were agriculturists when they founded this settlement.

In this connection belong also the sharp-edged flakes of flint, like those found at Susa and in remains of the early dynastic period in Egypt, where they were fastened, with asphalt or Nile clay, in grooves in wooden sickles to form the cutting edge. Professor Flinders Petrie told me that the Egyptians made their first sickles of the jaw bone of an ass by cementing flakes of flint in the grooves which had held the teeth.

That the peoples of the three older civilizations were related appears from the practice, common to all three, of burying children under the earthen floor of the dwelling, often on the ashes of a hearth. There must be thousands of these skeletons in the mounds, nearly all of them buried on the side in the "contracted position," i.e., with the knees drawn up to the chin, as when in the mother's womb. Many of them were interred with gifts—usually beads. In

TURCOMAN WOMAN BAKING BREAD

CAMEL TRAIN COMING TO MERV

some cases in each of the three cultures these beads were of turquoise or of lapis-lazuli. The chief source of turquoise is now not far distant, in Persia, but the only known source of lapis-lazuli is far to the east in or near Afghanistan.

Then, too, the great quantities of the same type of spindle-whorls found in all of the three cultures showed that spinning was an industry common to them. In the three older settlements were found stone mace-heads (*casse têtes*)—stone discs pierced for fastening to the end of a stick. In the oldest culture this was the only weapon observed of offense or of the chase.

All three cultures had domestic animals; and I shall show farther on that the process of domestication was begun on this or on neighboring oases during the lifetime of the oldest (the Stone Age) culture—Anau I.

The second culture—Anau II—is the period of transition from the Stone to the Copper Age; for the few small fragments of implements of that metal indicate that copper was beginning to be known somewhere within the range of communication. A copper dagger is recorded as from this culture, but, as it was found on the surface, it may have been of later date.

Well-shaped sling-stones are in this culture added to the stone mace-heads, and, if we except the doubtfully placed dagger, they formed the only weapons of offense or of the chase found in débris of this period. Since here as in Culture I no traces were found of the use of stone for points of arrows or of spears, it it not improbable that fire-hardened pointed sticks served that purpose.

S. K. Anau III. The founding of the settlement, of which the upward growing débris was to form the greater part of the South Kurgan, marked the beginning of the third culture—Anau III. A great change was apparent. Either there had been a time gap since the abandonment of the North Kurgan, or a related people had come in from a distant and more advanced civilization. A relationship appeared in the practice of burying children in a contracted position with gifts under the earthen floor of the dwellings, and in various objects shown in the table to have been common to this and the two older settlements. It is shown also, though obscurely, in some of the motives used in the few pieces of painting found on their pottery.

As soon as we began to dig we came upon evidences of great advance in culture. Excepting some kinds of coarse service ware,

the pottery had been made on the wheel. The potter had sought beauty in form rather than in painted decoration.

Then with the progress of the excavation we found ourselves in presence of a fully developed copper culture. A sickle, razor, dagger, lance-heads, arrow-points, ornaments, and minor articles of the red metal are proofs that the Stone Age and the period of transition had been left behind. Man had climbed to the second great stage of civilization, in which the possession of an easily manipulated metal immensely widened the range of possibilities in domestic industries and in warfare.*

In the débris of this settlement there were found objects of striking interest because they throw light upon the relation of the third culture to a distant center of civilization.

There were little figures of the Chaldean goddess Ishtar. There was also a seal having on one of its three sides a lion with wings, the head and beak of a bird.

Ishtar, under her several names, was the supreme female deity of the Chaldean sphere of religion—the "Mother of Gods," "Great Mother," goddess of life and death. Her representations are found in the Stone Age, and down through history till, as *"Magna Mater,"* she was brought to Rome.

The winged lion with the head of a bird is a design that appears first in the Archaic stage of Susa on tablets which Scheil, using the old chronology, dates before the fourth millennium. So this design also belongs to the sphere of Chaldean religions.

It is significant that the copper implements, and especially the daggers, razor, and sickle, are free from intentionally used tin. Two or three carried a fraction of one per cent of these—a dagger from the top of Anau III.

* The copper stage lasted in the early world—Chaldea—Egypt—until when in the second millennium B.C. there came into general use the hardening of copper by alloying it with 8 to 10 per cent tin, and thus producing bronze.

WEAVING SILK AT KARATAG IN THE MOUNTAINS OF BOKHARA

MANNER OF YOKING OXEN IN THE MOUNTAINS OF BOKHARA

APPENDIX II

RELATION OF ANAU TO SUSA

SINCE the publication of the results of my 1904 expedition, DeMorgan's Excavations at Susa in Chaldea have been finished and the results published and ably discussed. They throw light on Anau II and III.

Three culture periods were exposed in Susiana by the excavations of DeMorgan's expedition. The oldest, which we will call Susiana I, is Neolithic (later Stone Age). It contains abundant implements of flint, especially sharp flakes used to make the cutting edges of sickles, as in early Egypt. This shows local existence of agriculture. No arrow-heads or points were found.

Resting immediately upon this there appears, without any transition, both at Susa and at Tepe Moussian, a culture—Susiana II—characterized by a pottery made on the wheel and very artistically painted in geometric designs. The presence of well-wrought implements of copper, including mirrors, shows that this culture was well advanced in the Copper Age proper.

Above this, with an interval of about fifteen feet, is a culture I will call Susiana III. Its pottery is both geometric and naturalistic in its painting. The motives were derived from animals, plants, and men, and in the great number of pieces found the whole progress of stylization from the naturalistic to the geometric is clearly traceable, and furnishes a key for referring the geometric representations in Susiana II back to their naturalistic forms. M. Pottier, after an elaborate study of the designs and other objects of the two periods, comes to the conclusion that both belonged to people of the same civilization.

Now the absolute chronology of Susiana is closely interwoven with that of Chaldea, and M. Pottier, through a comparative study of similar typical and datable objects found in both Susa and the Chaldean city of Tello, has arrived at the definite conclusion that the culture I have called Susiana II cannot be older than 3000 B.C.

Relationship between the cultures of Anau II and III and Susiana II and III is shown in objects common to both regions—such as

spindle-whorls, mace-heads, and sickle-flints. There were also the figurines of Ishtar, alabaster vessels, the seal showing a winged and bird-headed lion, the copper sickle with bent-over tang, like one of the second millennium at Susa—all these from the later third of Anau III. To these must be added the stone weights found in Anau II and III.*

There is also similarity in some shapes of vessels, especially some with long spouts (Anau II and III and Susiana III); and in tall stemless goblets and cups on stems (Anau III and Susiana II).

All this might be taken to mean simply exchange of objects and ideas in current intercourse. However, there is far stronger evidence of a genetic relationship.

Solomon Reinach has said *"le culte precede l'art"*—twenty thousand years ago—paleolithic man covered the walls of dark caverns, in France and Spain, with well-drawn pictures of the wild animals that he hunted for food. The only explanation is magic—the belief that control may be had by representing the animal desired for food. From the time of the ancient Egyptians down to the Salem witches, if you wanted to kill an enemy you had only to represent him in wax or as a doll, and drown the image or stick it full of pins. The

* In excavating Anau II there was found an object carved from limestone, measuring 17 by 10 by 2½ inches. It had a hole cut through the top as if meant to hold it by. It showed much wear, and had been broken into two pieces. Contrary to the opinion of the archeologist, I thought it might be an exceedingly valuable document.

When in 1910 I received a copy of M. Decourdemanche's *Poids et Measures des Peuples Anciens* I sent him a photograph of the stone, and its weight as determined at the U. S. Subtreasury—12 kilogrammes and 943 grammes.

In his book M. Decourdemanche says that the Babylonian monetary type-talent was preceded by others: "*Talent of the masons.*" of the "*one thousand ounces,*" of the "*bricks,*" and "*the talent of weight.*" Farther, the talent of the masons was preceded by others which he called talent "A" *light* or *Babylonian* which should weigh 13 kilogrammes and 600 grammes, and talent "A" *normal* or *Egyptian* of 14k 166⅔ grammes = $\frac{1}{24}$ of the weight of "A" *light*. All the systems of talents derive from these.

He writes me that my stone weight, weighing 12k 943 gr., might, after allowing for wastage, well represent an earlier talent weighing 13k .056 gr. = $\frac{1}{24}$ of a talent "A" *light*, and would be the oldest talent of the series.

early Aryans muttered incantations while making earthen pots. The life of primitive man was, and is still, passed in a continuous attempt to hypnotize the spirit world.

The motives in the decoration of the pottery of Susiana and Anau are largely derived from immensely remote ancestral beliefs. The pottery of Susiana II is geometric, but in that of Susiana III we see the whole gradual change from purely naturalistic, through stylization, into a geometric extreme in which the origin of the motives is wholly lost. In this stage lies the key to the interpretation of the obscure forms, as shown in the monumental memoirs of Messieurs Gautier and Lampre, Toscanne, and Pottier.*

The predominant decoration used on the pottery of Susiana is derived from a tradition in which a serpent, a man, woman, steinbock, scorpion, and a tree are concerned. From it is derived the biblical account of the Garden of Eden, the Tree of Life, and The Temptation. It occurs in naturalistic form in many representations where the tree is between the man and the woman, the serpent erect standing behind with his head near the woman's.

The decoration of the pottery of the three Anau cultures is almost wholly geometric. Without the key offered by Susiana it would show no sufficing evidence of relationship of the widely separated cultures.

In Anau II and III we found only a few pieces of painted pottery, but among these there are motives which in Susiana decoration would mean the "Tree of Life" and the serpent and tree often naturalistic. Also in Anau I we have what may be stylizations of the tree and serpent similar to some of those on Susiana pottery, but most of the motives in this culture consist of simple shapes which, if stylized, no longer show their origin. They are mostly solid or trellis-filled triangles—motives common to widely separated parts of the world.

Since the tree and serpent are essentially symbols of the primitive cult of Susa or of Sumer, their presence on pottery of Anau is presumptive evidence of more or less remote cultural or racial relationship of the cultures of Anau and Susiana. It would seem that they all radiated from a common primitive home, remote in time and space, and that their differences developed along diverging routes.

The extreme degeneration of motives of design through stylization

* *Delegation en Perse.* Volumes † VIII, ‡ XII, * XIII.

on pottery of Anau I does not prove that culture to be younger than that of Susiana II, for I shall show that Anau I is by far the older.

Messieurs Gautier and Lampre, who conducted and described the excavations of Tepé Moussian, ascribe the civilization of Susiana II to the stage of "transition from the age of stone to that of bronze." The presence of mirrors of copper are evidence that Susiana II belonged in the Copper Age proper, and was later than the æneolithic stage in which that metal was beginning to be known.*

A comparison of the cultures of Susiana with those of Anau shows that while Anau III, as a fully developed copper culture, was in part or wholly contemporaneous with Susiana II and III, Anau II being in the æneolithic, or transitional stage from stone to copper, must be older than 3000 B.C. and belong in the latter half of the fourth millennium B.C.

I come now to the oldest of all the cultures, that of Anau I, which forms the lower forty-five feet of the North Kurgan. It belongs in the Stone Age.

When Dr. Duerst received the bags of bones he was so much interested that he gave up to their study nearly three years of his University work. Out of the whole sending he found, for determining, about 3,500 bones, of which nearly one-third belonged to skulls, lower jaws, and teeth, the rest chiefly to the extremeties.†

To summarize briefly the results:

Excepting human skeletons, the lower five feet of the North Kurgan culture strata contained bones only of wild animals. Above this the remaining forty feet of culture strata of Anau I contain the record of the progress of domestication successively of the ox, pig, and sheep—and probably of the horse—

* Prehistoric time, as connected with human activity, is now classified as follows (Montelius):

Iron Age, beginning about 1100 B.C.

Bronze Age, from about 1900 to 1125 B.C.

Copper Age, (Southern Europe) about 2500 to 1900 B.C.

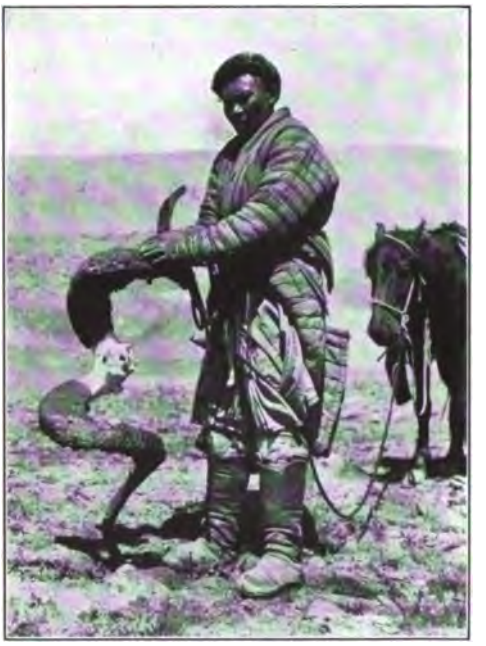
" " (Egypt) " 3400 to 1900 B.C.

Neolithic, (New Stone Age) Europe, ended in Egypt about 3400 B.C.

Paleolithic, (Old Stone Age) Europe, ended with last retreat of the ice of the Glacial Epoch in V Millennium B.C. or earlier.

† Dr. Duerst's exhaustive report is printed in *Explorations in Turkestan, Expedition of 1904, Prehistoric Civilizations of Anau*, R. Pumpelly, Director, Carnegie Institution of Washington.

THE TOKUS KUNGAI GLACIER AND MT. KAUFMAN



HORNS OF THE OVIS POLI ON THE PAMIR

out of the wild forms of the region. This is shown by the increasing porosity of the bones under the changed conditions of life, and by diminishing size of the animals.

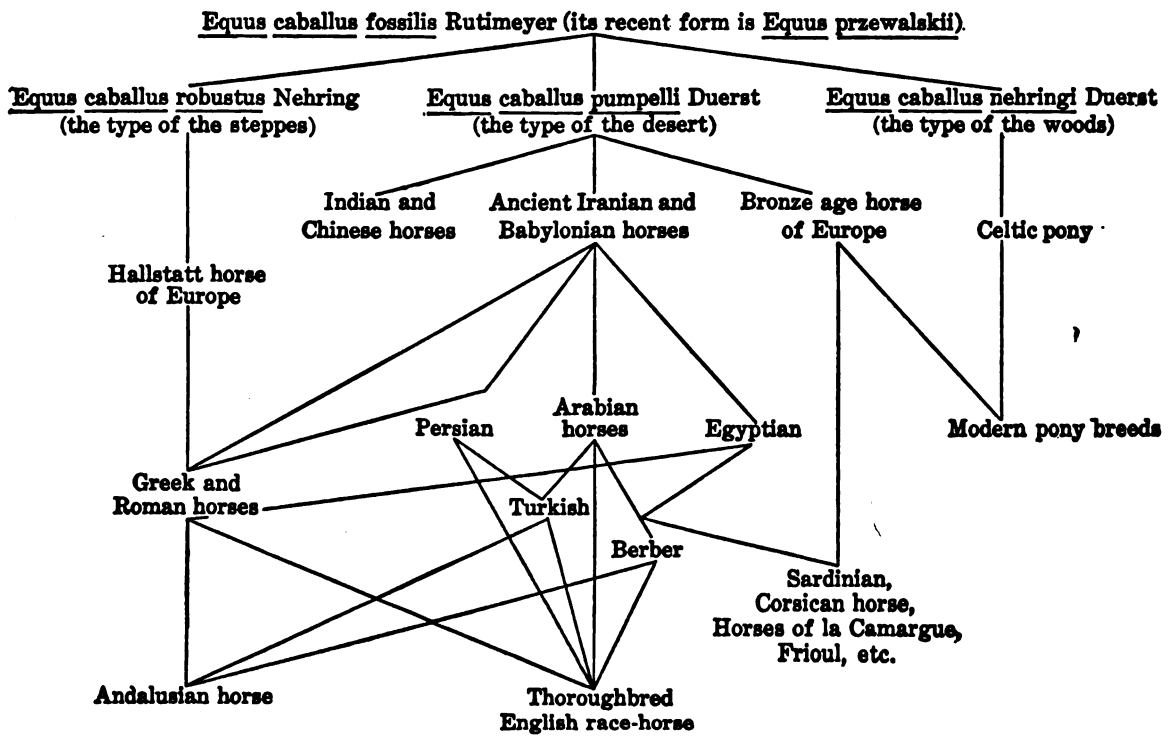
First of all, out of the great Bos *namadicus*—the Asiatic form of the *Urus* (*Bos primigenius*)—there was developed a large and stately bovid with long horns, which Duerst says is the same ox that was possessed by the ancient Egyptians. This domesticated, long-horned ox continues through Anau I and II, as do also, though less frequently, bones of the wild form.

At the end of Anau I or beginning of Anau II there appeared a short-horned breed which Dr. Duerst thinks was derived, perhaps through changed climatic conditions, from the long-horned stock, though it may have been brought in by the newcomers of Anau II, along with the goat, dog, and camel, all of which appear to have arrived there as already domesticated animals.

Remains of an already domesticated pig begin in the culture strata of Anau I, from twelve feet above the base, upward.

The lower culture strata—Anau I—contain also the bones of a wild sheep, whose descendants still live on the neighboring range of the Kopet-dagh. They are of the Genus *Ovis Vignei*, and are closely related to the mouflon of Corsica and to the "bighorn" of our Rocky Mountains. At twenty-eight feet above the base of Anau I, this animal had already become domesticated and somewhat smaller in body, with smaller horns. While this form persisted till the end of Anau I a smaller variety was being evolved, until there was formed an established breed identical with *Ovis palustris*—the "turbary sheep," *Torf-schaf*—of Europe. Its remains appear, with those of the long and short-horned oxen and turbary pig, in the late Stone Age dwellings of Switzerland, and in contemporary neolithic stations through Europe, without any signs of having been domesticated there from local wild forms. A hornless breed of sheep appears in Anau II, probably brought by immigrants from another oasis.

Bones of the horse abound in the strata of Anau I. Professor Duerst thinks this animal was probably domesticated, although in the horse domestication does not affect the density of the bones, as in other animals. In any event, that of Anau I was descended from the wild form of *Equus przewalski*, and was the ancestor of the thin-limbed Arabian stock, as Duerst shows in the accompanying table.


Equus caballus fossilis Rutimeyer (its recent form is Equus przewalskii).
Equus caballus robustus Nehring (the type of the steppes)
Equus caballus pumpelli Duerst (the type of the desert)
Equus caballus nehringi Duerst (the type of the woods)
Indian and Chinese horses
Ancient Iranian and Babylonian horses
Bronze age horse of Europe
Celtic pony
Hallstatt horse of Europe
Arabian horses
Persian
Egyptian
Modern pony breeds
Greek and Roman horses
Turkish
Berber
Sardinian, Corsican horse, Horses of la Camargue, Frioul, etc.
Andalusian horse
Thoroughbred English race-horse

The bones of children buried in the earthen floors on the dwellings were so badly crushed that only a few skulls were saved by Mr. Langdon Warner, whose especial care they were. Of these Professor Guiseppi Sergi of Rome was able to mount and measure seven; besides these there were two of adults. They were all of a "dolichocephalic"—"long-headed"—type of man, and Professor Sergi told me that dolichocephaly in the infant state becomes even more marked in the adult.

The importance of this discovery lies in the fact that the people of Anau I and Anau II were not of the Mongoloid type. Professor Sergi says: "The results shown above give a certainty to my hypothesis of some years ago* on the probable penetration into Central Asia of one branch of the Mediterranean variety."

In my report to the Carnegie Institution, of the results of the Expedition of 1904, I made a tentative estimate of the ages of the civilizations uncovered in the two Kurgans at Anau. This estimate was based partly on the assumed rate of stratigraphic growth checked by measurement of the datable rate of growth of several village mounds in Egypt. However, in the final estimate there were uncertainties as to time gaps between the civilizations, in some important datings under the then accepted chronology of Babylonia and Egypt, and in comparisons with the results of DeMorgan's excavations at Susa.

In the meantime great changes have been made in chronology, and new light thrown on the civilizations of Susa, and their relation to those of Anau and Babylonia, make it necessary for me to revise my datings of the Anau cultures.†

* G. Sergi, *The Mediterranean Race.* 1901, Appletons. New York.

† *Rate of Growth of Culture Strata, Anau I and II 1341.*

In volume I of *Results of the 1904 Expedition* I used a tentative method in converting stratigraphic into absolute chronology. This method was based on the rate of growth of culture strata in the city of Anau which is said by the *Mullahs* to have been founded, or fortified by the Sassanian monarch Chosroes I (Anu Shirvan) in the 6th century A.D., when he fortified his northern and eastern frontiers against the White Huns. Glazed pottery, probably Persian, made its first appearance in Merv with Sassanian coins, and makes its first appearance in the lower strata at the city of Anau. The mosque was built in 1444, and the city abandoned in 1884. By using these dates—Chosroes, mosque, and abandonment of the city—and assuming a uniform rate of growth of culture strata, we had the rate of total growth—that from

How old is Anau I? To begin with, it is older than the æneolithic strata of Anau II, which overlie it. Anau II, belonging in the æneolithic age as already shown, must be older than the copper culture of Susiana II, which M. Pottier, reasoning from comparison with Tello, places at 3000 B.C. and which may be a few centuries older.

Anau I belongs clearly in the Stone Age.* Aside from this the only basis for further reasoning exists in the results of Professor Duerst's study of the remains of animals domesticated by the people of Anau I. Among these Duerst shows, as stated above, that the long and short-horned cattle, the pig, and the second breed of sheep are identical with those brought from Asia to Europe, during neolithic time, by round-head immigrants who were probably Celts.†

How long did it take for the turbary sheep, pig, and cattle of Anau to reach the West and spread over the large part of Europe where their remains abound in neolithic stations? In this same extent of time and space is contained the whole history of the migration of a Celtic branch of the Aryans, of the changing con-

Chosroes to building of mosque, and that from mosque to abandonment. These rates, varying from 2.25 to 2.66 feet per century, averaged nearly 2.50 feet. In the South Kurgan, where the strata were much denser, I arbitrarily assumed a rate of two feet.

Realizing the uncertainties involved in this estimate, my son and I measured the datable rate of growth of village mounds at six Egyptian localities, rates ranging from 1.35 to 1.90 feet and averaging 1.6 feet per century. There is here too an element of uncertainty in the greater tenacity of mud of the Nile as compared with the alluvium of Anau.

In the light of M. Pottier's estimate for the age of Susa, based as it is on Babylonian Chronology, my estimate, as far as the age of Anau II and III is concerned, is clearly too high—how much too high can be determined only when we may know the length of time gaps between Anau II and III and between M. Pottier's first and second periods of pottery.

I realize now that, in estimating that of the Kurgans, it was wrong to use the rate of growth of the city of Anau—for the city was built of burnt bricks, which were used over and over again, while in the Kurgans the rapid destruction of the houses of sun-dried mud required a corresponding addition of earth brought from without.

* The few small pieces of copper found in the upper two feet of Anau I cannot be positively assigned to that culture.

† A small herd of the same sheep still exists in the Grisons in Switzerland, and another in Wales, in both places among people of the Celtic race.

ditions that forced them out of their primitive home, and of the expansion of their civilization over Europe during the Stone Age.

Penck places the beginning of the Neolithic Age in Europe at about 5000 B.C.

Montelius dates the arrival of the Aryans, Celts, with domesticated animals, in the IV millennium—between 4000 and 3000 B.C.

Die Alpen im Eiszeit Alter, p. 1168.

Orient und Europa, pp. 31-35.

As there was no dog in Anau I, the absence of the dog of Anau II until after 1500 B.C.—in the Bronze Age—makes it probable that the domestic animals left Turkestan before Anau II.

Who were the people who domesticated these animals? Professor Sergi says they were probably of Mediterranean stock migrated to Asia. The primitive man of the West—from the Baltic to Cape Good Hope was long-headed. Primitive man of most of Asia was broad-headed. Though we know as yet little about how these races were distributed in Central Asia seven millenniums ago, it is probable that until after the last great glacial advance the lofty Hindu Kush and Tien Shan ranges remained the western limit of the very broad-headed Mongols.

Now on the western slope of this great barrier live the Aryan-speaking Galchas, a moderately broad-headed people of the Celtic Alpine type. The anthropologist, Ujfalvy, after studying these peoples, concluded that in forming these broad heads there was a crossing of a tall, blonde long-haired people on an Asiatic stock. The Bavarian physician, F. von Schwarz, long in Russian service in Turkestan,* was impressed by the resemblances between the Galchas and the Alpine peasantry of Bavaria, in racial type, dwellings, and customs. They were agriculturists and raisers of fruits. Are Galchas the result of a crossing of the Mediterranean type of Anau with the primitive Asiatic stock?

However this may be, the people who brought the turbary sheep and pig and cattle of Anau to Europe were probably Galchas.

In Anau I, I think, we have the oldest instance of an organized agricultural civilization at present known. Since it was fully developed when the settlement was founded, it must have evolved out of a remote background, and somewhere at some time in that vast background of time and space there was a primitive home from

* Franz v. Schwarz, *Turkestan, die Wiege der Indogermanischen Völker.* Freiburg, 1900.

which radiated the civilizations of Anau, Susa, and Chaldea. All of these were oasis cultures and were achieved only through the slow development of cereals and fruits out of the wild forms, and the utilizing of every foot of irrigable land. In this primitive home was thus laid the foundation of Western civilization.

Where was the primitive home in which arose agricultural civilization? Not in Europe, for there these elements of culture appear first as brought from Asia in the Stone Age.

If the long-headed people of Anau I came from Europe or from Africa, it would seem that the migration must have occurred well back in an interglacial period, 75,000 or 100,000 years ago; for no stone axes, arrow-heads, or lance points were found in Anau I or II, although abundant small implements of stone, scrapers, saws, and flakes for the cutting edge of sickles showed a knowledge of flint industry. It is not conceivable that a people who had once used stone for weapons of war or chase would have abandoned their use. The same condition is shown in Susiana, where, in the Stone Age, at Tepé Mohammed Djaffar, vast quantities of flints were worked to make small domestic implements and flakes for sickle edges but where no traces were found of stone axes, arrow-heads, or lance points. The surface of Europe and northern Africa was covered with these weapons from early in the last interglacial epoch. And at least Africa, and probably Mesopotamia, were cut off from Trans-Caspia by the ice-covered heights of Armenia and the Zagros mountains, till after the retreat of the ice of the Daun advance at perhaps about the time of the founding of Anau I at the North Kurgan. So it is among the oases of Central Asia that we must imagine agriculture to have developed.

The plains of Central Asia are deserts or semiarid regions. Agriculture is possible only where oases are formed by water from the high mountains, and on them, through the ages, the excess of population over the productive capacity of the limited acreage had either to starve or migrate.

Before the domestication of animals migration was possible only from oasis to oasis. It seems probable that the migration by which, in the Stone Age, the domestic animals were brought to Europe, lay along the edge of the Persian plateau, south of the Caspian, and north of the Caucasus and Black Sea, to ascend the Danube—a route offering a pasturage for herds and along which agriculture was here and there possible.

The alternative would be that, while agriculture was carried by

A Hunting Eagle in the Mountains of Bokhara

A Bridge in the Mountains of Bokhara

this route, the domestic animals were carried later by nomads after the nomad-shepherd condition of life had had time to develop. However, the story of the earliest migrations and their vicissitudes, and reactions upon their environments, through a vast extent of time and space, remains to be unravelled by the archæologist, and it will be the most facinating chapter in prehistory.

The fact that the agricultural and animal-breeding civilization of the long-headed people of Anau I was brought to Europe by the round-headed Celtic stock recalls Sergi's hypothesis that the Aryan language was taken to Asia by a variety of his dolichocephalic Mediterranean race, and was there impressed on a round-headed Asiatic people who in turn brought it to Europe, and imposed it upon the peoples they conquered.*

There can be little doubt that the great migrations out of the Orient were due to the increase of population to beyond the nourishing capacity of the soil. In their earlier stage of society they were in the centrifugal or hunter's stage, when mankind dependent on wild game was during thousands of millenniums peopling the earth by slow dispersion from one, or from plural centers of origin. With the development of agriculture there came the first great change toward civilization—concentration into organized village communities fixedly settled on oases.

Our finds show that already at the beginning of Anau I they lived in houses, and had the art of spinning and doubtless of weaving, and they were expert makers and decorators of varieties of coarse and fine pottery. The use of chaff in one kind of pottery shows the cultivation of both wheat and barley.†

The next great step in civilization was the domestication of animals.

Doubtless this largely increased the means of subsistence beyond what was supplied by agriculture, for grasses of the semiarid land beyond the oases furnished pasture for expanding herds.

We may assume that under fixed conditions of environment the birthrate would adjust itself to the limitations set by Nature, but the conditions of environment were not fixed.

In the effort to learn why the base of the South Kurgan, which

* G. Sergi, *The Mediterranean Race.* London, 1901.

† The débris under Swiss lake dwellings of the Stone Age, showing a wide range of cereals and garden products and varied textile fabrics preserved under water, give a startling realization of the extent of the civilization brought from the oases of Turkestan.

was founded so long after its northern neighbor, was buried to the same depth in alluvial deposits we found, by sinking many shafts, that during the life of the four cultures there had been three aggradings—upward growths of the alluvial plain—and two intermediate deep erosions. It was a simple geological study, in which fragments of the very distinctive potteries of the four cultures served as do fossils in geology.*

The aggradings indicate a period of greater precipitation on the mountains and on the bordering lowlands, as contrasted with erosion during the dryer part of a climatic cycle.

In the report we have given reasons for assigning these to climatic changes rather than to mountain movements.†

Now the significant result of this investigation was the discovery that the North Kurgan was founded during an aggrading—increasing flow of silt-bearing water—that reached its maximum toward the end of Anau I, and then turned toward dryness. The South Kurgan—Anau III—was founded during the aggrading of a later climatic cycle, which reached its maximum near the end of the culture. So again with Anau IV (iron culture), and the city of Anau, their life fell within the next aggrading. The life of each culture was confined to the favorable part of the climatic cycle. The trend toward dryness made emigration necessary.‡

As I have said above, it seems probable that the earlier migration, which brought agriculture and breeding of animals to Europe, moved along the oases of Turkestan and the southern and western shores of the Caspian, and along the Caucasus and Black Sea to the Danube—a route on which stages of intermittent settlement were possible.

Later migrations came after the possession of domestic milk-and-flesh-yielding animals had made possible the development of nomad life, and its spread over the semiarid plains of Eurasia, and when change toward dryness had restricted the extent of grazing capacity of the plains to below the needs of the swollen population.

* *Explorations in Turkestan.* "Prehistoric Civilization of Anau. Expeditions of 1904." Vol. I, pp. 20-30.

† *Explorations in Turkestan.* "Prehistoric Civilization of Anau. Expeditions of 1904." Vol. I.

‡ I have no change to make in the argument concerning the climatic cycles and their relation to the life of the cultures as presented on p. 52 graphically and in text, except as affected uniformly by the changes in the new datings.

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re idealized.

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At an early period domestic animals were carried far in other directions. Professor Duerst identifies the long-horned bovid *Bos taurus macroceros*, with the sacred bull Apis of Egypt, where it was worshiped in the middle of the fourth millennium. It had, doubtless, come much earlier from the East, for in that remote time when the Sumerians, not yet having entered Chaldea, used a pictographic form of writing, their ideogram for domestic cattle was as distinguished from the wild bovid .*

In revising the datings given in volume I of my report of the Expedition of 1904, in the light of the new chronology and of M. Pottier's study of the results of M. DeMorgan's finished excavations in Susiana, I would substitute the following table:

Anau II and Anau III ca. 3500 to 1000 B.C.

(Anau II, from the paucity of copper, would seem to belong earlier in the æneolithic period and earlier than Susa I.)

Since the turbary sheep appeared throughout Europe in the Stone Age not later than during the fourth millennium, it would probably have left the oases in the fifth millennium. Anau I would have been founded in the sixth millennium, or earlier, for we have no means of determining, even roughly, the time when Anau I ended. We only know that this happened before the founding of Anau II, which I have given reason for dating 3500 B.C.

The interest in all this does not lie in the question of dates. A few hundred years more or less matter little in the prodigiously long vista of social evolution. What does matter is the fact that what we found at Anau was evidence that, in the Stone Age, long, long before the Sumerians founded the civilization of Babylonia, and while Europe was still in the hunting and cave-dwelling stage, there had been developed in Central Asia the fundamentals of our industrial life—agriculture, breeding of animals, weaving, and

* "From a survey of the objects represented in the earlier form of the Sumerian ideographic writing we reach the general conclusion that the script originated at a time when a considerable advance in culture had already been made, and in which agricultural conditions prevailed, in which animals had been domesticated, and the gods identified with personification of the stars, by the side of the sun and moon."

organized society in village communities—and that these elements of our civilization were brought to Europe by our ancestors.

The culture of Anau I, in all its stages, doubtless typical of that of many other oases communities, is a record of the first critical phase in the progress of civilization, of an evolution slowly developing through ages in the glacial period. The next great turning point was the migration to Europe.

THE END

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